Support to the development of an ecological network and spatial data infrastructure for the Sava River

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Alterra-rapport 1195

Alterra, Wageningen, 2005

ABSTRACT

Rooij, S.A.M. van, T. van der Sluis & A. M. Schmidt, 2005. *Support to the development of an ecological network and spatial data infrastructure for the Sava river*. Wageningen, Alterra, Alterra-rapport 1195. 124 blz.; 13 figs.; 7 tables.; 18 refs.

This report is one of the results of the project "Integrated transboundary River Basin Management Plan for the Sava". The process and (intermediate) results are presented that are obtained on the work packages of geographical and ecological information and ecological network development. The overall project supports the implementation integrated river basin management by the Sava River Basin Commission, which was established in June 2005. In expectation of the establishment of this commission, this project was carried out in cooperation with national Nature conservation institutes of the Sava river basin countries (Slovenia, Croatia, Bosnia-Herzegovina and Serbia-Montenegro).

Keywords: data inventory, ecological networks, GIS, River management

ISSN 1566-7197

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[Alterra-rapport 1195/09/2005]

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Summary

This report is one of the results of the project "Integrated transboundary River Basin Management Plan for the Sava". The process and (intermediate) results are presented that are obtained on the work packages of geographical and ecological information and ecological network development. The overall project supports the implementation integrated river basin management by the Sava River Basin Commission, which was established in June 2005. In expectation of the establishment of this commission, this project was carried out in cooperation with national Nature conservation institutes of the Sava river basin countries (Slovenia, Croatia, Bosnia-Herzegovina and Serbia-Montenegro).

Geographical and ecological information
For an integrated river basin management and the development of an ecological network, spatial geographical and ecological data are required. For these purposes, an overview of the available data in the four Sava river basin countries was acquired.

There appeared to be large differences between the geographical and ecological data availability between the Sava river basin countries. In Slovenia and Croatia, many data are present and an overview of data present was easily obtained. In Bosnia-Herzegovina and Serbia-Montenegro, only little data were present and no overview of available data existed. Therefore, an inventory of geographical and ecological data was carried out for Bosnia-Herzegovina and Serbia-Montenegro by the national institutes. The metadata of the available data were stored in an electronic meta database that is made available through the internet (http://webgrs.wur.nl/cgi/projects/sava-metadata/).

Important for a basin wide approach, as the Sava River Basin Commission will apply, the exchange of data between the Sava river basin countries is required. The involved institutes acknowledge this and have the ambition to facilitate the exchange of data between the institutes for such purposes. Agreed was that the Croatian institute will coordinate and facilitate the exchange and management of spatial data. To facilitate this, a Spatial Data Infrastructure (SDI) was designed, purchased and implemented at the Croatian institute. For the actual exchange of data, the institutes need to agree on the user restrictions of the data exchanged.

Ecological network development
For the exchange of practises and transfer of knowledge on ecological networks two workshops were organised with the involved institutes. In these workshops, a shared language and understanding of the principles and approaches of ecological networks was obtained. A method for assessing and designing ecological networks was handed and practised on the Sava river basin.
The first steps and decisions were made by the participants towards the assessment and design of an ecological network along the Sava river, as a selection of habitats of interest, definition of the study area and a preliminary choice of focal species. These are intermediate results on which can be build further in future projects. As the

collection and collation of data was not feasible at the moment of the workshop, as agreements on the exchange and use of data between the institutes were not made yet, outlines of an ecological network could not be designed. However, capacity has been build and preporatory work has been done for the design of ecological network in a future project. Also, some preliminary conclusions could be drawn on the ecological networks along the Sava.

The understanding of the functioning of ecological networks and the required ecological data (the quality of habitat and the presence of focal species) also enables to make choices in the gathering of field data. As an exercise and as a start for further research, the Bosnian institute drew up a plan for the transboundary gathering of ecological field data along the Sava.

Conclusions

This project has laid a base on the the future development of a GIS for the Sava River Basin Commissoin and the development of an ecological network along the Sava river. The data inventory and the spatial data infrastructure offer the opportunity of collecting, and exchanging and combining data that are required for an integral transboundary river management including nature protection. The required next step is to make agreements between the involved institutes on the exchange of data and on user restrictions, and to make agreements with the Sava River Basin Commission for the use of data and the management of the data infrastructure.

When agreements have been made, the selected data, required for the assessment of the functional ecological networks can be collected. For the ecological network assessment, habitats and species provisionally have been selected.

Further, the Sava river offers good opportunities for the development of combined retention and nature areas. In the framework of the Action Programme of the ICPDR, a a long-term flood protection and retention strategy will be developed, basied on the enhancement of natural retention. When measures for both safety and nature in natural retention areas will be taken, there is very good opportunity for a safe Sava river basin with a high biodiversity. Recommendations on the required research and actions to utilize this opportunity are made.

1 Introduction

1.1 Framework of the project

This report is one of the results of the project "Integrated transboundary River Basin Management Plan for the SAVA" which is funded by *Partners for Water* and lead by the International Agricultural Centre (IAC). Alterra was contracted to carry out parts of the project in the field of Geographical Information (GIS), Ecological networks and the Water Framework Directive. This report is the report of the activities and results in the field of GIS and Ecology.

The overall project supports the implementation of priority actions on integrated river basin management as indicated in the Interim Action Plan for the Sava River. The content of the project plan was based on various discussions with the Interim Sava river basin Commission and has been tuned with the UNDP/GEF Programme on the Sava.

1.2 Objectives

Starting point of this project was the project proposal, made in 2001. Elements in this proposal that was dealt with by Alterra were:

- Support to the drafting of an ecological network along the Sava (as part of a future ecologically sound flood protection plan)
- Support to the establishment of a basin wide GIS of the Sava River.
- Support in the field of water quality, typology and reference criteria of aquatic ecosystems.

1.3 Developments and adjustments during the project

1.3.1 Changes and inhibiting factors in the project environment

The project environment of this project was very complex. Unexpected conditions and developments necessitated us to adapt the approach, focus and final results in the run of the project, tailored to the situation. This in order to contribute most effective to the original objectives, as put down in the project plan.
The most important unexpected developments and inhibiting factors are the following:

Delay in the establishment of the Sava River Basin Commission
In December 2002, the establishment of the Sava River Basin Commission was foreseen by the end of 2003. This was delayed several times, and finally took place at the 27th - 29th of June 2005, just before the end of this project. As the Sava River Basin Commission and the accompanying Expert Groups were the beneficiaries of this project, their involvement was of crucial importance for this project. In first

instance, activities in the framework of this project have been delayed, in expectation of the establishment of the Sava River Basin Commission. Later on, it was decided to identify and involve other relevant beneficiaries. The result was a delay in the actual start of the project and the dedication of a significant amount of time to identify and involve relevant national institutes in the four Sava river basin countries.

Changes in focus, approach and products
As new beneficiaries, national institutes on nature conservation in the four Sava river basin countries have been identified and involved in the project. Together representatives of these institutes, the needs and interests that fit in the scope of this project were identified and discussed. Based on that and on later communication, the focus and approach adopted in this project was adapted to their needs. Most important decisions during the project were the following:

> Observed was a large difference in data availability, data infrastructure and acquaintance with European directives between Slovenia and Croatia on the one hand and Bosnia-Herzegovina and Serbia-Montenegro on the other. Decided was to **focus on the assistance of and knowledge transfer to Bosnia-Herzegovina and Serbia-Montenegro**, to level out this difference a bit. The role of the institutes of Slovenia and Croatia was to share and exchange their knowledge, practices and experiences with the other countries and with each other.
>
> On the field of "water quality, typology and reference conditions", it appeared that the needs of the institutes of Bosnia-Herzegovina and Serbia-Montenegro were on gaining knowledge on the implementation of the Water Framework Directive (WFD), as in the setting up of a typology and reference conditions. Therefore the **focus** in this work package was on the **WFD, typology and reference conditions**. In discussion with the beneficiary institutes, **training** in this field appeared to be the most appropriate way of knowledge transfer. The issue of water quality was not further addressed.
>
> In the original project plan, setting up a GIS for the Sava River Basin Commission and advising on the implementation and further management of the GIS were planned. As the establishment of the Sava Commission took more time than was foreseen and the cooperation with the ISPDR GIS-expert group did not work out, the final products have been slightly changed. During a workshop with the representatives of the beneficiary institutes of the Sava river basin countries, it was concluded that the establishment of a Sava river basin wide GIS was not feasible under the present conditions. Therefore, it was proposed **to design and implement a spatial data infrastructure (SDI)** by means of which all the involved institutes in the present project (and follow up projects) are able to exchange metadata and/or data. Depending on the user restrictions of the datasets the data can be made available as well to the Sava Commission for the purpose of transboundary river basin management.

Priority and capacity of beneficiary institutes for contribution to the project
As a result of the delays in the project and the fixed end date of the project, the timeframe for carrying out the data inventory and work on ecological networks was very short (6 months). This meant that there was a very tight planning of activities and (intermediate) results, which was only feasible with full cooperation of the beneficiary institutes and by bringing the required capacity on the institutes into action. During the project it appeared that the priority given to this project by the beneficiary institutes and the capacity that was contributed to this project was not always optimal. This, and also the little time available, often resulted in not or late carrying out the agreed actions.
As a consequence:

- the **data inventory is not complete**, however a good basis is laid.
- It was **not feasible to select and gather data** to gather them in a database. Here for, an extensive discussion with the institutes on user restrictions would be required, for which was no time in this framework.
- the **work in the field of ecological network has the nature of capacity building**. As the required spatial information was not available in time, it was not feasible to design an ecological network along the Sava, but the methods and approaches have been discussed and exercised on the Sava river area.

As the Ecological institute of Bosnia-Herzegovina had enough capacity and priority for this project, they were asked to set up **proposal for the gathering of field data along the Sava** river, using the information and knowledge that was transferred and exchanged during the workshops. The writing of this proposal was meant as an exercise to apply the knowledge and insights that were gathered, to seek cooperation with their neighbouring countries and can be used as a starting point for a future project.

1.3.2 Final products

The final products that were achieved are the following:

- Overview of metadata, on the biotic and abiotic data on the Sava river basin of the Sava river basin countries.
- An electronic metadata tool, in which metadata are gathered.
- Facilitating exchange of practices and discussion on the storage of ecological data in accordance with requirements of the European legislation.
- Design, purchase and implementation of a Spatial Data Infrastructure for the exchange of spatial data between the Sava river basin Countries
- Capacity building on the assessment and design of ecological networks, tailored to the situation in the Sava river basin.
- Contribution to the training in the field of the Water Framework Directive.
- Proposal for the gathering of field data along the Sava River.

1.4 Beneficiaries

Originally, the Sava Commission was the beneficiary of this project. As this Commission was established later as foreseen, other beneficiaries were chosen. It was then decided to identify national institutes or ministries of the four Sava river basin countries that are most relevant for the project and the results foreseen. The identified institutes that were involved are listed in Table 1.

Table 1 Beneficiary institutes of the four Sava river basin countries that were involved in this project.

Country	Institute/Ministry	Location
Slovenia	Institute of the Republic of Slovenia for Nature Conservation	Ljubljana
Croatia	State Institute for Nature Protection	Zagreb
	Ministry of Culture	Sarajevo
Bosnia-Herzegovina	Center for Ecology and Natural Resources (CEPRES), Faculty of Science University of Sarajevo	Sarajevo
	Agricultural Institute	Banja Luka
Serbia-Montenegro	Institute for nature conservation of Serbia	Beograd

1.5 Introduction on the Sava river

The Sava River, which is 861 km long, is the Danube's second largest sub catchment area (95,719 km^2) after the Tisza. Based on its discharge (average 1,564 m^3/s), the Sava is by far the largest tributary of the Danube (DPRP, 1999; ICPDR, 2004). Its catchment area is located in the four former Yugoslavian countries Slovenia, Croatia, Bosnia-Herzegovina and Serbia-Montenegro (Figure 1). Its main tributaries, sorted from the source downwards, are the Ljubljanica (flows through Ljubljana), Savinja, Mirna, Krka, Sotla/Sutla, Kupa/Kolpa, Lonja, Orljava, Bosut, Una, Vrbas, Ukrina, Bosna, Tinja, Lukovac, Drina and Kolubara rivers

Slovenia
The Sava has two main sources, both in the north-western, Alpine region of Slovenia. The spring of Sava Dolinka is in Zelenci near Kranjska Gora. The other leg of the river originates as Savica ("little Sava") and then flows into Lake Bohinj, which it leaves as Sava Bohinjka. Both legs of meet at Radovljica, and the river is known as the Sava past that point. The Sava then flows through the Sava valley towards Croatia.

Croatia
The Sava River runs through Croatia for 510 km and is the largest river in the country. It is the border with Slovenia for 2 km and with Bosnia and Herzegovina for 311 km. Its catchment area is 25,000 km2, which is 44% of the national territory. In Croatia, the largest alluvial wetlands in the Danube Basin are situated (DPRP, 1999). The Sava tributaries are important for the preservation of the high biodiversity (Schneider-Jacoby, 2003). They lead into the Central Sava river basin. With 1,120 km^2 the Central Sava river basin is the largest floodplain ecosystem in the Danube River basin (13% of the total area of remaining floodplains along the Danube and its larger tributaries. However, this is only 38% of the original surface of areas that were frequently inundated before the flood control programme started.

As a result of the flood control programme (1972), large alluvial wetlands were preserved in the seventies as retention areas (e.g. Lonjsko Polje). These retention areas are not only a key site for flood protection in Croatia, but also for the whole Sava river basin (Scheider-Jacoby, 2003).

Bosnia-Herzegovina

After Barudanovic et al., 2005.

The Sava river is the natural boundary of the northern area of Bosnia and Herzegovina to Croatia and Serbia-Montenegro. The catchment area of the Sava river (including Sava's major tributaries Una, Vrbas, Bosna and Drina) provides 75,5% of water resources of Bosnia and Herzegovina (NEAP, 2003) and its catchment area makes up 75 % of the of the country (51,129 km^2). The majority of the Bosnian population inhabits this region.

The catchment area of the Sava river in Bosnia-Herzegovina is highly heterogeneous:

- In morphology: small rivers originate from high peaks of Bosnian mountains (Maglić, Volujak, Bjelašnica, Igman, Vranica, Vlašić, Klekovača, Šator, Osječenica etc.), smaller subpannonian mountains (Majevica, Motajica, Kozara, Grmeč) and hills, leading to the Pannonian lowland.
- In Climate: a vertical gradient exists of the high Dinarids submediteranian to subalpine and alpine areas. On the horizontal profile, the climate of the Sava river catchment area is under influence of the sub-mediteranian climate in the canyons of river Una and Vrbas, under the temperate continental climate in the region of central Dinarids, and under the continental climate in the northern part of Bosnia and specific subpannonian and pannonian along Sava river, which is similar to submediteranian climate.
- In geological substrate; huge part of this area is situated on the calcareous rocks of different age. Besides, there are certain parts on the siliceous rocks. One of the largest complexes with siliceous substrata is situated in the upper flow of Vrbas River, so called mountain Vranica region.
- Peculiar characteristic of this area is presence of peridote and serpentine rocks, which make a broad zone of ofiolits and extend from east to west part of Bosnia (Višegrad, Olovo, Krivaja river valley, Žepče, Maglaj, Banja Luka, Prijedor).
- In soils, as a result of different type of geological substrata.

This heterogeneity caused a high level of landscape diversity and a high biodiversity, among which many endemic species.

In Sava catchment area in Bosnia-Herzegovina two national parks are present: "Kozara" and "Sutjeska". Study for establishing the third national park in area of Una catchment area is in process.

Serbia-Montenegro

(After Aitic et al., 2005)

The Sava River and its major right tributary Drina, forms the natural border between Serbia-Montenegro and Bosnia-Herzegovina. The Sava River with all tributaries constitutes 30% of water resources of Serbia and its catchment area occupies 31,046

km^2. As in Bosnia, the Sava river originates from the highest Dinaric peaks. Coming from south to the north along major tributary Drina River, a great diversity of soil as well as flora and fauna can be found. In the south there are different types of geological substrata. In Dinaric part, different types of calcareous soils are present. Flora and fauna of these parts of the Sava catchment area have many endemic, glacial and tertiary relics. In the upstream canyons of the tributaries a great diversity of flora and fauna can be found, because they represent refugial centers. The valley of the Sava River is situated on deep alluvial sediments, where hydromorphous type of soil with many oxbows, reed lands and wetlands. The diversity of flora and fauna in this part is not very high, as the larger part of this region is under agricultural exploitation. The only piece of natural vegetation is situated in and around two protected areas Obedska bara and Zasavica. Here we have communities of old oak woods.

Figure 1 Location of the Sava River and its main tributaries.

2 Method and approaches

2.1 General approach and working procedure

As the Sava Commission was established later as foreseen, new beneficiaries were to be found. For this, national institutes or Ministries of the four Sava river basin countries were identified that are most relevant for the project and its foreseen results. Point of departure was to involve them in the project as much as possible in order to:

- Get a good overview of available information in the countries itself (often not available in English);
- Promote transboundary cooperation between institutes of the four countries of former Yugoslavia;
- Promote exchange of information and approaches between institutes in the four former Yugoslavian countries;
- Capacity building by presenting and applying approaches that are part of contemporary sustainable water and nature management (sustainable biodiversity, Natura 2000, Water Framework Directive).

The working procedure in the project was as follows (see Table 2):

Inception mission March 2004

In an inception mission in March 2004 contact persons of ministries and national institutes have been visited to assess the needs and the degree in which data are available. It appeared that in Slovenia and Croatia many suitable data are present. In the Bosnia-Herzegovina and Serbia-Montenegro however, much less data appeared to be available and much was unclear about the existence and location of suitable data. Therefore, it was decided to focus on the inventory of the data and knowledge present on biotic and abiotic aspects of the Sava river basin on Bosnia-Herzegovina and Serbia-Montenegro.

Renewal of the work plan

After new beneficiary institutes were identified and their interest and needs were assessed, the work plan was revised. Main activities that were scheduled were:

- Assesment of ecological data within the Sava River Basin, with focus on Bosnia-Herzegovina and Serbia-Montenegro
- Data management. Advice on the choice of databases, support in the field of data management.
- Training / Workshop on Natura 2000 and Protected areas network within Sava River Basin.
- Inventory of ecological data
- Biodiversity assessment and flood management

The activities that could be achieved was of course closely linked with the capacity that the beneficiary institutes could invest in this project.

The activities in this work plan were presented by IAC to these institutes and they expressed their interest to cooperate.

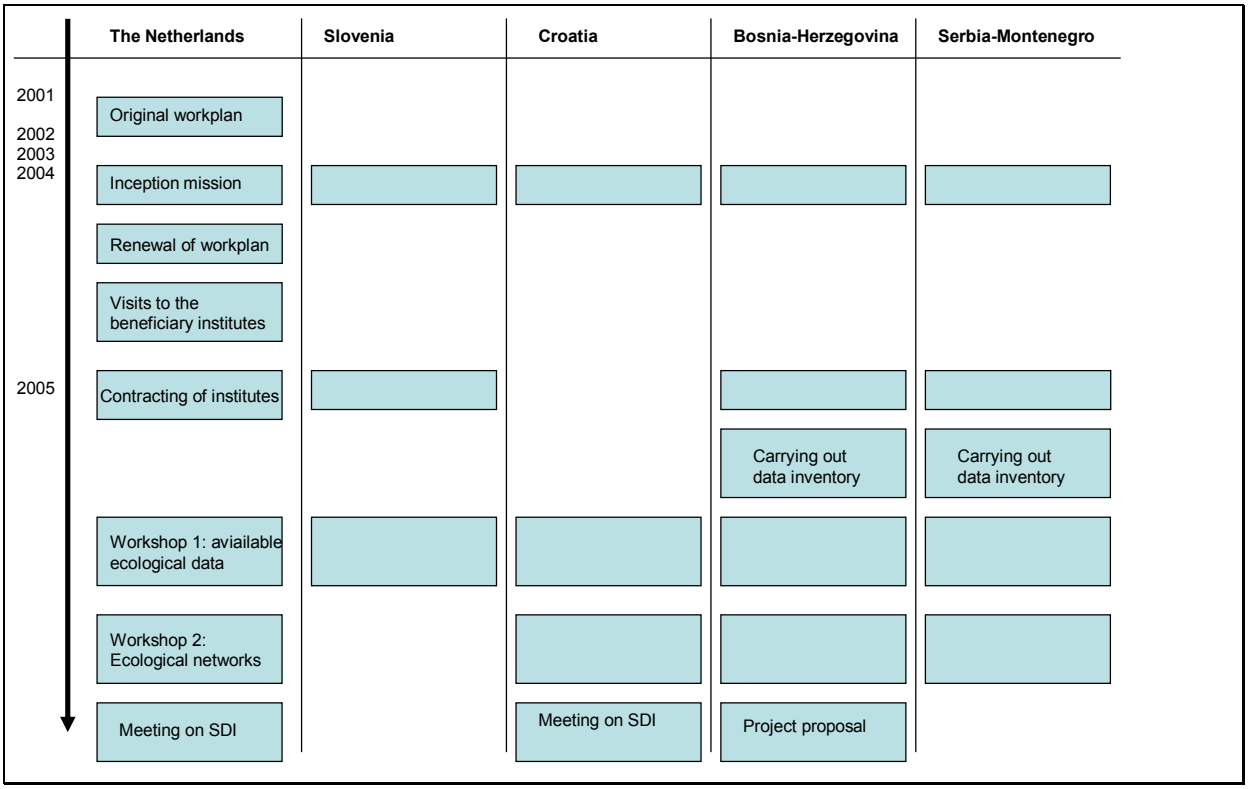


Figure 2 Diagram of working procedure in the project and the countries involved in the activities that are carried out. The involved institutes in the Netherlands were IAC and Alterra, for involved institutes in the other countries mentioned, see Table 2.

Visits to the benificary institutes

In November and December 2004 the institutes have been visited to explore the availability of ecological and basic data and maps and to discuss how an inventory of available data of the Sava catchment area could be set up in the framework of this project. It appeared that the institutes in Slovenia and Croatia could present a good overview on available ecological and relevant GIS data, and that they had no capacity available or benefit to put a lot a work in the gathering of metadata of the Sava river catchment area. Agreed was that Alterra would make an overview based on the presentations of data, that would be filled up or corrected by the Institute of the Republic of Slovenia for Nature Conservation and the State Institute for Nature Protection of Croatia. Further, the institute of the Republic of Slovenia for Nature Conservation indicated that it had little capacity to participate in the foreseen workshops in the framework of this project. They could only participate if their expenses for the required time were paid for.

As the institutes in Bosnia-Herzegovina and Serbia-Montenegro had to start from scratch, they were contracted to carry out a data and expert inventory. Also the preparations for and participation of the planned workshop were included in the contract.

Contracting of institutes

The institutes of Bosnia-Herzegovina and Serbia-Montenegro were contracted to prepare an overview of metadata of ecological and other data of the river catchment area of the Sava river, including its tributaries, on their territory. The requested overview was on fields mentioned in box 1. Metadata forms for data and for experts where drawn up in dialogue with the institutes that would carry out the inventories, tailored to the foreseen use of the metadata. Further, a metadata tool was designed and made available on the internet to store the metadata in a easy to use manner.

Further, the Institute of the Republic of Slovenia for Nature Conservation was contracted to make preparations for and participate in the Workshop on available ecological data.

Box 1: Topics on which data and expert inventory were requested

Overview of available ecological data: (Restricted to wetlands and riverine ecosystems)
- Species protected by national policies
- Red list species (of national red lists if available, or otherwise red lists of IUCN)
- species that are protected by the European Habitat and Bird directive
- endemic species
- characteristic riverine species
- Also attention for invasive species

Overview of basic data (covering entire Sava catchment area):
- Topography (which projection system?)
- remote sensing images
- land use
- protected areas
- hydrological data, if relevant for flooding and biodiversity

Overview of additional abiotic data (covering entire Sava catchment area):
- Physical geographical regions
- Soil
- Location of river Sava and tributaries
- Flooded areas
- Catchment area of the Sava river
- Elevation, Digital Terrain Model

Overview of ecological experts and of relevant expert institutes

Workshop 1: Available data

On 4 and 5 april 2005, an two day workshop was held in Zagreb, hosted by the State Institute for Nature Protection of Croatia, titled: **"**Available data on the Sava river basin and requirements for the analyses of ecological networks along the Sava". Invited were delegates of all beneficiary institutes with experience in the field of ecology and/or GIS and experts of the study area.

Workshop 2: Ecological networks

On 30 and 31th of June 2005, a second two day workshop was held in Sarajevo, titled: "Ecological Network development for the Sava river basin". Objectives of this workshop were:

- Recapture of progress / decisions workshop April
- Overview of available data on selected riverine habitats
- Selection of suitable species for the development of an ecological network of these habitats
- Putting distribution data on the map: Identification of important habitat areas (how does the ecological network now look like?)
- Analysis of the spatial cohesion of the ecological network and proposals for improvement
- GIS: feasibility of gathering data in GIS; how to deal with user restrictions?

Invited were GIS and ecology specialists of the beneficiary institutes and asked was to bring specialists of species or sites along the Sava of interest.

Meeting of GIS-experts

On 21st and 22nd of June 2005, a delegation from the State Institute for Nature Protection of Croatia has visited Alterra. They have had working meetings with experts on GIS and data exchange of Alterra and have set up an infrastructure for data exchange for data on the Sava river basin (Spatial Data Infrastructure; SDI).
A visit of an expert of Alterra for the implementation of the SDI in the Croatian institute was planned, but is postponed to September as a result of the required custom formalities for the import of the server.

Making proposal for field inventory

As the institute from Bosnia-Herzegovina had the time, interest and capacity, they have written a project proposal for transboundary gathering of ecological field data along the Sava river in the framework of this project. This project proposal builds further on the knowledge exchange and transfer in the workshops and can be used a base for next projects in which opportunities exist for gathering field data along the Sava.

2.2 Approach for ecological networks

Biological diversity is highly dependent on the quality, quantity and spatial cohesion of natural areas. Fragmentation severely affects the spatial cohesion of habitat and in this way the abundance of species. Due to fragmentation and environmental pressure biodiversity decreases: we are rapidly losing species that cannot survive anymore in the present landscape.

2.2.1 Assessment of ecological networks

To see whether a landscape functions as an effective network for certain species, ecological networks in a landscape can be assessed. This can be done by focusing on "focal species". These focal species are indicative for other species; information for the selected species can be extrapolated for the group of species they represent. With an ecological network assessment it can be shown whether available (fragments of) habitat areas are large and coherent enough for focal species to survive on the long term. This approach is useful to compare conditions for sustainable biodiversity in the current situation with the situation in development scenarios. Also, options for the improvement of the ecological network can be detected.

To define the ecological network function, an analysis method has been developed based on the theory of metapopulations and ecological networks (see Box 2). The metapopulation theory states that in fragmented landscapes populations of animal species do not live in a continuous habitat but live in a network of habitat patches. The habitat patches are mutually connected by dispersal movements (Levins 1970, Andrén, 1994, Hanski & Gilpin, 1997, Opdam, 2002). Whether an ecological network can sustain a persistent population or not, depends on:

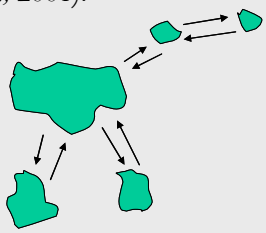
- characteristics of a species (habitat preference, home range, dispersal capacity)
- the amount, shape and area of habitat patches in a landscape
- connectivity of the landscape, which defines how easily species can move to other habitat patches (spatial configuration of habitat patches).

The habitat types analyzed are aquatic (river, oxbows, ponds) and terrestrial (riparian forest, meadows, sandy islands and steep river banks. The situation is assessed for a number of relevant species for each ecosystem. The selected species include some short-range species, e.g. reptiles, amphibians, mammals, which are all vulnerable for fragmentation. In addition, some bird species are included in the analysis.

Box 2: Concept of metapopulations and ecological networks

When natural habitat becomes fragmented as a result of landscape changes, small isolated patches are often too small to sustain viable populations. These small, local populations are always at risk from extinction, due to local 'disasters' or stochastic processes, e.g. fire, pollution, or storms. Occasionally breeding may also fail, with disastrous consequences for small populations of few individuals. So the small populations regularly become extinct. When these local populations are connected in an ecological network, the total area of habitat patches can offer possibilities for persistent populations of species.

Large populations with a very low probability of extinction, the so-called 'key populations', constitute the strong parts in a metapopulation occupying an ecological network (Verboom *et al.,* 2001). From these 'key patches' a net flow of individuals to other habitat patches in an ecological network takes place. In this way immigration occurs from key patches to local populations that became extinct. If there are many patches this process can increase overall sustainability. We consider this a metapopulation (Levins 1970, Andrén 1994). A metapopulation is sustainable if the chance of extinction is less than 5% in 100 years (Shaffer 1981, Verboom *et al.,* 2001).



Schematic presentation of a metapopulation; In green habitat patches that sustain local populations, the arrows represent movements of individuals on dispersal.

Standards used to decide whether a metapopulation is sustainable or not are specific for each species. Small, short living species (for example, insects) are more vulnerable and require more individuals for a persistent population than larger, long living species (like the *Beaver*). For less mobile species habitat patches should be situated closer together to form part of a coherent ecological network. Further, the area demands of e.g. insects for habitat are smaller than for larger species as Roedeer.

2.2.2 Ecological network development

Based on the theory of networks, it was proposed to use the following phases to develop an ecological network:

- inventory of available and existing data (see box 1)
- selection of priority ecosystems
- selection of focal species
- data compilation of focal species in database
- map collection of ecosystems/land use in GIS
- a workshop analysis of existing land cover / habitat maps and species data
- design of the ecological network, in a workshop, with specialists involved.

During the process this work plan had to be adjusted; the start of the network development was late, despite the fact that this plan was prepared in May, approval was received only in October from PfW, but various other causes resulted in a delay.

Finally the approach was changed as follows:

- inventory of available and existing data on species and habitats
- joint selection of priority ecosystems (workshop 1)
- joint selection of focal species (workshop 2)
- a workshop analysis of existing land cover / habitat maps and species data
- design of the ecological network, in a workshop, with specialists involved.

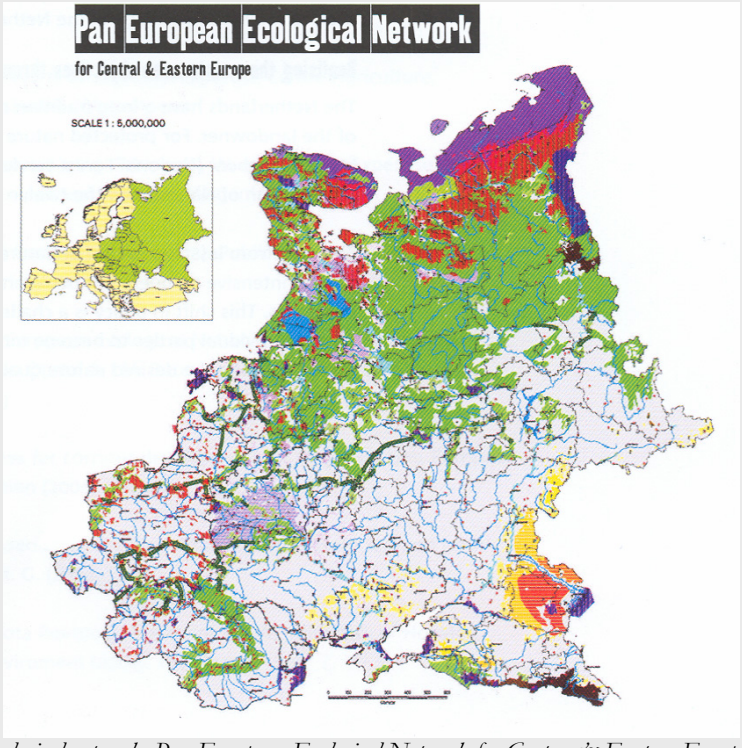
In particular the availability of land cover, habitat, topographical maps etc. formed a bottleneck; they were partly not available, or formal agreements were lacking to come to exchange or sharing of maps.
So the last two steps, the analysis of maps and drawing of the ecological network could not be done in the way it was meant to be done. Instead improvisation was required with Remote Sensing maps, based on Landsat TM, covering the entire Sava River basin.

Box 3: Development of ecological networks

If wildlife is spread over large areas, in low numbers, and if these remaining areas are too small, wildlife species will disappear sooner or later. An answer to this problem is the development of an ecological network, linking nature areas by means of corridors and small habitat patches (Vos *et al.*, 2002; Van der Sluis *et al.* 2004; Bouwma *et al.* 2004).

The development of ecological networks is part of European policy (Bern Convention, Habitat directive, Natura 2000), and has resulted in the development of the Pan European Ecological Network PEEN. European ecological networks especially can be beneficial for large herbivores like red deer or top predators like wolves, bear, lynx and otter (Van der Sluis *et al.* 2004, Foppen *et al.* 2000). However, in first instance many small organisms will benefit from improvements in spatial cohesion and expansion of natural habitats.

Many European countries are attempting to realize ecological networks at a national or regional scale (Rientjes & Roumelioti, 2003).



Example of an ecological network: Pan European Ecological Network for Centra & Eastern Europe (from: Hootsmans & Kampf, 2004).

2.3 Approach for storing geographical information

2.3.1 Choice for Spatial Data structure

The original aim of the present project was to establish a Sava river basin wide Geographic Information System (GIS). End user of this GIS was supposed to be the Sava Commission. The GIS should support the Sava Commission in transboundary integrated river basin management.

As the establishment of the Sava Commission took more time than was foreseen and the cooperation with the ISPDR GIS-expert group did not work out, the aim of the GIS work package has been slightly changed. In discussion with the involved institutes, it was decided to chose for the design an implementation of a spatial data infrastructure (SDI).

2.3.2 Inventory of datasets

Within the present project an inventory has been made of spatial datasets at different scale levels, namely Global, European and national level. For the purpose of this inventory the data spatial data components (data categories) that are defined within the European initiative Infrastructure for Spatial Information for Europe (http://www.ec-gis.org/inspire/) have been used as a starting point (see Appendix 8). The present project is focused on integrated water management so only the spatial data components (data categories) for both water and nature management should considered. As the cooperation with the GIS-expert group of ISPDR did not take place and the institutes involved in the present project are all working in the field of nature conservation the inventory of datasets has been mainly focused on nature management (biodiversity).

3 Results

3.1 Selection of partners

The identified partner for the project is the Sava River Basin commission. Due to delays, this commission formally was installed only two days before the project ended.

In different brief visits to the region it was assessed what good potential partners are, that are also active or should be involved in the ecological network development.

In March 2004 all Sava river basin countries were visited, and the project was presented, with the aim to:

- define priorities for the countries (in regard of support for the WFD, ecological network development and GIS)
- assess their needs and requirements
- identify partners

Based on these visits, contacts were made with research institutes; governmental institutes for nature conservation, government officials from the departments (or ministries) of water affairs, and environmental planning. Based on this, contacts were established with the relevant research institutes, and at the same time contacts were maintained with the government officials responsible for nature conservation, biodiversity or ecological networks (Table 2). The overview presented in Table 2 is not complete, but for the countries involved these were the most important contacts.

Table 2 Involved insitutes in the Sava river basin countries and contact persons that contributed to the project.

Country	**Institute**	**Person(s)**
Slovenia	Inst. of the Republic of Slovenia for nature conservation	Mrs. Debeljak, Mr. Vrcek
Croatia	Min. of Culture	Mr. Draganovic
	State Inst. for Nature Protection	Mrs. Radovic, Mr. Trenc, Mrs. Amidzic
	Nat. Park Lonjsko Polje	Mr. Gugic
Bosnia-Hercegovina	Faculty of Sciences/ CEPRES	Prof. Redzic, Mrs Barudanovic
	Fed. Min. of Envir. planning	Mr. Cero, Mrs. Korac-Mehmedovic
	Min. of physical planning, Rep. Srpska	Mr. Laganin
	Agricultural Institute, Rep. Srpska	Mr. Predic
Serbia & Montenegro	Inst. for nature conservation of Serbia	Mrs. Amidzic, Mr. Brankovic, Mrs.. Dimovic, Mr.. Marincic, Mr. Ajtic
	Inst. for Biol. Research	Mr. Karadzic, Mr. Paunovic

3.2 Report Workshop 1: Data inventory

The first workshop was held at 4th and 5th of April 2005 in Zagreb and was titled: "Available data on the Sava river basin and requirements for the analyses of ecological networks along the Sava". All four beneficiary institutes where represented and had prepared presentations for the workshop.

Issues addressed in this workshop were:

- available spatial ecological data in the Sava river basin
- The approach of functional ecological networks.
- Approach of ecological network development in the Sava basin countries
- Selection of available data that is suitable for the analyses and development of a tentative ecological network along the Sava River and its tributaries.
- Preparation of an outline for the development of a GIS for the Sava river basin
- Exchanging experiences on the set up of an ecological network and the use of GIS and databases for Natura 2000 purposes.

A full report is attached to this report in appendix 2.

The most important results of this workshop were:

- Presentations of all beneficiary institutes on available biotic and abiotic (GIS)data in their respective countries.
- Presentations (by institutes of Croatia, Slovenia and Alterra) on ecological networks and discussions on differences in approaches.
- An agreed definition of the study area: *The floodplain area along the Sava river (focused on selection of habitats/habitat types) including areas in the river basin that are functionally connected with areas in the Sava floodplain*".
- Selection of species groups of most interest for this project (based on data availability, useful for the approach of functional ecological networks)
    - Amphibians/Reptiles
    - birds
- Selection of habitat types, agreed was to focus on:
    - Wet grasslands
    - Oxbow lakes, ponds and open water
    - Alluvial forest; hardwood forest / softwood forest

  These habitat types have been defined by using the EUNIS classification (see appendix 3).
- Discussions on GIS for the Sava river basin. The importance of a joint GIS is recognised by all participants.
- The Croatian participants indicated that they are interested to play a central role in the setting up- and development of a GIS database. Other partners support this idea.
- Available data, required for the next workshop on ecological networks, were selected and participants were requested to send these to Alterra. Alterra would collate and print these data, to use them in the next workshop on ecological networks. All partners thought that the sending of this data in time was feasible.

- The data inventories by the institutes in Bosnia-Herzegovina and Serbia-Montenegro were not yet finalised.

The following was concluded in the evaluation of the workshop:

- The Slovenian participants had doubts about the surplus value of this project for the institute. However exchange of experiences and knowledge was interesting.
- The Croatian participants found the workshop very useful, especially the exchange of experiences and state of affaires with GIS.
- The participants from Bosnia – Herzegovina found the workshop more than useful; for Bosnia there is much to learn of the experiences and state of affairs in Croatia and Slovenia. To catch up is very difficult and ambitious but this project is a start.
- The participants of Serbia – Montenegro had to leave early; so they could not give their opinion on the workshop.

3.3 Inventory of available data

An inventory was made of the data that were owned by the institutes of Croatia and Slovenia. The results are presented in appendix 4.

Both in Bosnia and Serbia metadata on available ecological data and/or maps were compiled. Alterra contracted CEPRES in Sarajevo and the Institute for Nature Conservation in Belgrade. These inventory studies were done in a period of only three months, and therefore they can not be considered complete. In particular since the information is dispersed due to the wars which were taking place in the area.

The Bosnian data inventory shows that available data is fragmented. The data that exist is often for one specific area. Only few studies have a complete coverage of the Bosnian territory, due to recent changes in geography of the countries. Since then funds for surveys and field investigations were very limited.
Vascular plants are best covered in existing data, but still the data is limited. For plants a database is available of species, including endemic species. Most sources assessed in this overview date back from the period before 1990 and only few are more recent. Most recent publications have all a local coverage (Brcko, Vranica), except for the list of botanical forms for the Red Data book of Bosnia and Herzegovina. For birds, 6 publications were found, of which only one dates from 2005. For fishes only 3 publications are listed for different rivers, despite the fact that it is an important group with regard of endemic species. Even more striking is that for mammals, generally a group which is well covered in research, no publications are available, except for a list of 10 endangered species from Brcko district. Similar for amphibian species, 7 Habitats directive species are known to exist in the Sava catchment area.

Box 3 Differences in approaches in ecological network development

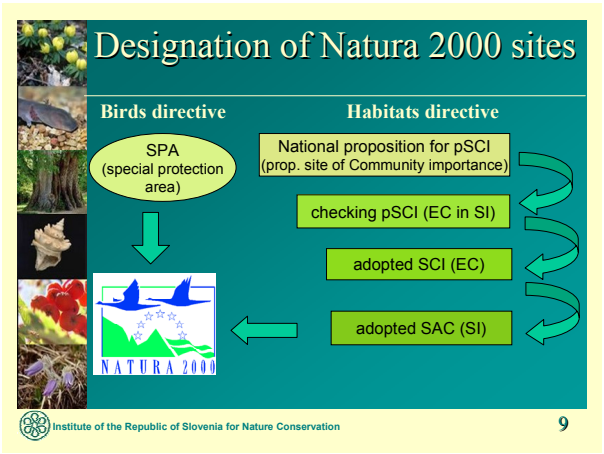
In the workshop significant time was spent on the discussion on different approaches to develop ecological networks. Both the Croatian and Slovenian Institute had been involved in the process of the development of a national ecological network. Participants of both countries presented the approach adopted and the final results.

Approach in the development of a national ecological network in Slovenia

In Slovenia, the development of the National Ecological Network (NEN) was coordinated by the Ministry of the Environment and Spatial Planning. The ecological network is based on the sites that are indicated or proposed Natura2000 sites. The National Ecological Network has a certain, guiding, policy status.

For the indication of NATURA 2000 sites and the development of the Ecological network, the following steps were taken:

- Gathering of available scientific data, preparing basic ecological data for habitat types and species (e.g. basic biological characteristics, distribution, population status, threats)
- reports were prepared by experts from various national institutions (both governmental and NGOs)



In the next phase, propositions for Natura 2000 sites for Slovenia were prepared. And information on ecological requirements, conservation status of habitat types and species and their representation in Slovenia was prepared.

This has resulted in:
- 6 special protection areas (SPA), coverage: 461.819 ha (22,8 % of Slovenia)
- 260 proposed sites of community importance (pSCI), coverage: 639.734 ha (31,6 % of Slovenia)

The SPA and pSCI sites together cover 720.287 ha (35,5 % of Slovenia).

Finally, between Natura 2000 sites ecological corridors were added, connecting important areas in the resulting national ecological network.

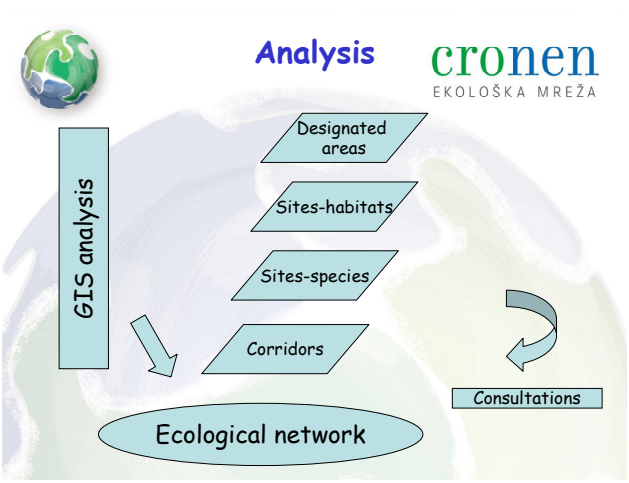
Approach in the development of a national ecological network in Croatia

Also in Croatia, the national ecological network is based on the sites that are indicated or proposed Natura2000 sites. Also here, the National Ecological Network has a certain, guiding, policy status.

The areas that constitute the National Ecological Network were selected with GIS, based on the following data:
- Data on distribution of focal species and habitats (Birds Directive, Habitats Directive; national Red Lists, endemic species)
- Distribution maps for focal species and habitats (based on results of project: Red Data Books and Habitat mapping)

- Identification of sites important for focal species and habitats
- Other GIS data, e.g. Ramsar and UNESCO sites and Prime Butterfly Areas

This resulted in a map of the proposed National ecological network. National parks and nature parks cover 85% of the protected sites in the national network (10% of Croatian territory). A preliminary evaluation based on Natura 2000 criteria was performed on the selected sites in the Ecological network. A problem appeared to be the lack of data on the distribution and abundance of target species/habitats for Natura 2000.



Also in Croatia, between Natura 2000 sites ecological corridors were added, straightforward and simple, connecting important areas in the national ecological network.

Approach ecological networks presented by Alterra

The approach of ecological networks adopted by Alterra is based on the metapopulation theory. An ecological network is defined as a network of habitat patches of a species of interest, which are mutually connected by dispersal movements of individuals of this species. When a population in one habitat patch extincts as a result of normal stochastically fluctuations in populations size, the patch can be recolonized by this species by colonization from another habitat patch (see also paragraph 2.2). A sustainable ecological, or habitat network requires a certain area and coherence of habitat patches, which is species specific.

So, from this perspective an ecological network:

- Is a functional ecological network, and defined by the spatial characteristics of a species; here for focal species can be used that represent a range of species with similar habitat preferences area requirement and dispersal capacity.
- has no policy or political status.

This approach can be used to analyze the ecological networks in a landscape for species of interest and evaluate if it is large and coherent enough for a sustainable populations and to identify requirements to make it sustainable. This approach can also be used to develop and underpin a "political" ecological network with a policy status. In that case it, the ecological networks of a range of species should be evaluated and improved in such degree that it functions as a sustainable network for a range of species (see van Rooij *et al.*, 2003a & 2003b).

For the data inventory in Serbia-Montenegro, metadata were gathered on data on hydrology (29), birds (12), mammals (9), insects (5; on Cerambycidae) fish (5), plants (4), amphibians (1) and reptiles (1). The literature of the library of the Institute for Nature Conservation of Serbia was consulted. Many of these publications are on a specific site and/or specific species or contain general information on an area that is much broader than the Sava river basin (e.g. former Yugoslavia). On the nature reserve Obedska Bara, relatively many data are present (birds, plants). Distribution data on a national level only are available for mammals. Further, relatively many publications mentioned are on, rare, relict species that occur in the upstream parts of the tributaries of the Sava river.

The data that are listed are almost all analogue and comprise books, scientific and applicative papers. Worth mentioning is a review of vegetation with characteristic species and analysis in the lower part of the Sava river basin from Belgrade to Šabac by the University of Belgrade from 1955. On flora and fauna same databases exist.The Institute for nature conservation of Serbia however has recently started working on the foundation of the digital data base on protected areas in Serbia-Montenegro.

Due to lack of long-term studies and monitoring there is little known on the distribution on species in the Sava river basin. In the past few years, continual monitoring of some specific areas were conducted, and the foundation of data bases is in progress. An example is the monitoring of the European beaver in the Zasavica and Obedska bara in the framework of a reintroduction program.

Further, it appeared in the workshop that scanned topographical maps of Serbia-Montenegro are available, on the scales of 1: 25.000, 1:50.000, 1:100.000 and 1:300.000. The metadata of these maps are not yet described in the data inventory.

Box 4 Relation with the study: "evaluation of wetlands and floodplain areas in the Danube river basin"

A study on the evaluation of wetlands and floodplain areas in the Danube river basin has been carried out by the WWF in 1999, in the framework of the Daube pollution reduction programme (DPRP – Danube Pollution Reduction Programme, 1999). In this study three areas were identified as proposed wetland restoration area, due to its ecological importance, nutrient removal capacity and their role in flood protection: the floodplain next to Mokro Polje, the Kupa floodplain and the Drina Mouth (Figure 3). This study was done on the entire Danube River Basin and the final results and maps are very coarse.

There appear to be differences between the areas that are put on the map in that study, and the areas that the participants have mapped during the workshop. Some remarks after comparing the resulting pictures:

- In , wet grasslands are mapped only at the south side of the Sava, in Bosnia,. However, on the north side also appear to be many polders (Figure 5). This can be explained by the fact that the Bosnian areas were much deforested in the past, and the northern areas in Croatia still have a good (diverse) forest cover.
- The WWF map shows very wide floodplain areas on the north side of the Sava river, in Croatia. In the workshop, the large areas of wet grassland were mapped on the south side of the Sava, in the mouths of the tributaries, in Bosnia-Herzegovina (see Figure 5 and). The presence of so many polders north of the Sava, in Croatia were not identified by participants of the workshop.
- The absence of polders on the southern, Bosnian side, is remarkable. A Bosnian participant remarked that some areas in the western part of Bosnia are embanked. Also was mentioned that on the Bosnian side of the Sava, many areas were not embanked and still frequently flooded, causing a lot of damage.

In future projects on the evaluation and improvement of the ecological network along the Sava and its tributaries, habitat maps (wet grasslands, wetland etc.) will be made using GIS-datasets. It is important to pay attention to these remarks, to improve the quality of the mapping of the study area.

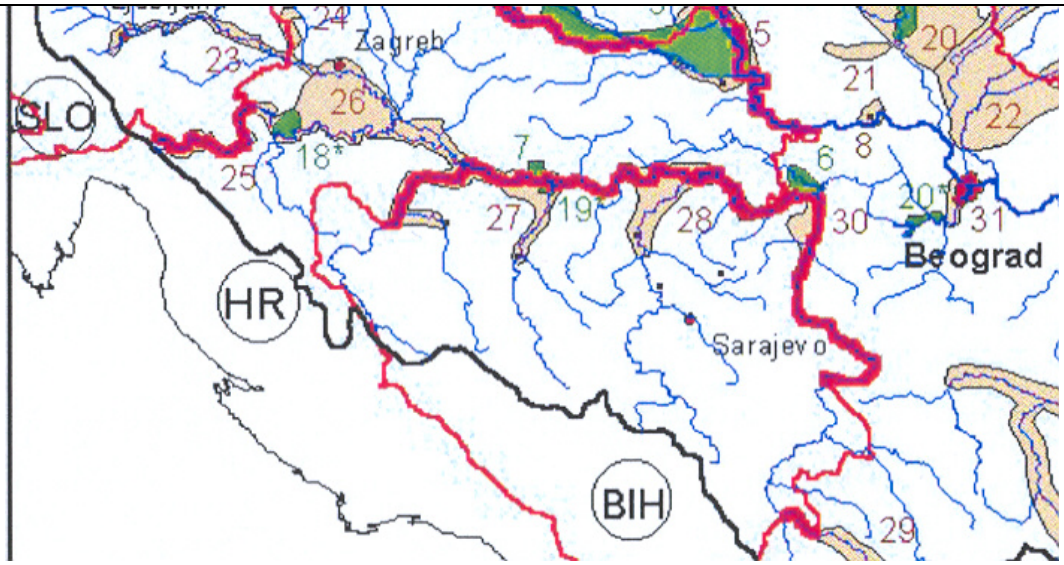


Figure 3 significant impact areas and priority wetlands for restoration (DPRP, 1999).

River / border

Significant impact areas:

23	upper sava (slo, hr)
24	Sutla (slo, hr)
25	Kupa (Slo, hr)
26	Middle Sava – Kupa (HR)
27	Middle Sava – Una & Vrbas (HR, BiH)
28	Lower Sava – Bosna (HR, BiH)
29	Tara Canyon (SM)
30	Lower Sava – Drina (BiH, SM)

Priority wetlands for restoration

6	Mouth of the Drina river (BiH, SM)
7	floodplain next to Mokro Polje (HR)
18	Kupa Floodplain (HR)
19	Mouth of the Vrbas River (BiH)
20	Obedska Bara (SM)

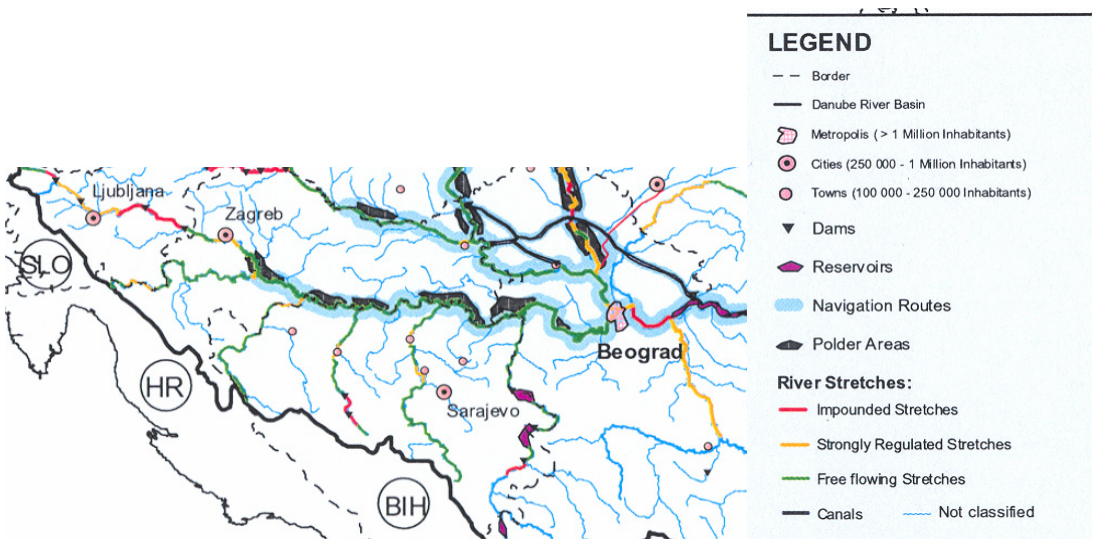


Figure 4 Major hydraulic structures and description of rivers in the Danube Basin (DPRP, 1999)

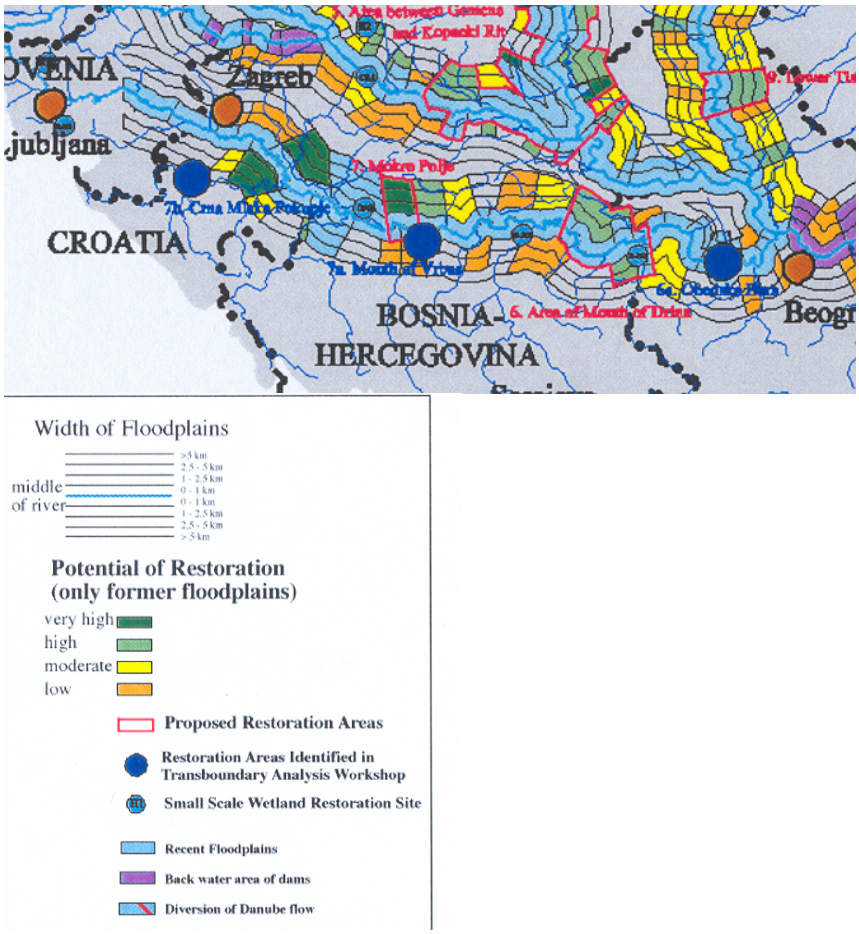


Figure 5 Restoration potential of former floodplains in the Danube River Basin (DPRP, 1999).

3.4 Report Workshop 2: Ecological networks

This workshop was held at the 30th and 31st of June 2005 in Sarajevo and was titled "Ecological Network development for the Sava river basin" (see appendix 5 for the report of this workshop).
Prior to the workshop, no data were sent by the beneficiary institutes to Alterra, as was agreed in workshop 1. Alterra requested then to bring (paper) maps to the workshop and people with good knowledge of the study area and/or species that occur there.

Delegates of the beneficiary institutes of Croatia, Bosnia-Herzegovina and Serbia-Montenegro participated in this workshop. The Institute of the Republic of Slovenia for Nature Conservation was not present, probably due to limited capacity and little advantage they see for their institute (see report workshop 1). Of Bosnia-Herzegovina and Serbia-Montenegro staff members with GIS and ecological knowledge were present, the one participant from Croatia had knowledge on GIS. Little basin wide information on species and sites was presented at the workshop.

Most interesting activities and results were:

- Presentation of the functional approach of Ecological Networks by Alterra, worked out in practical steps, and indication of the required knowledge.
- Hereafter: discussion on this approach. Important remarks of participants:
    - basic field data are lacking In the Sava river basin, assessment coherence of populations and habitat is a step too far! (supported by participants of all three countries)
    - All countries are in transition. This brings about many threats for natural areas nowadays; attention is required for these threats.
    - Making a link with the Habitats and Birds directive will enlarge the importance and impact of this project on the political agenda.
- Based on that, the ambition of the workshop is scaled down: this workshop will be an exercise of the ecological network approach and assessment.
- As little data or maps were available, Alterra downloaded LANDSAT-TM images of the study area and printed these on 1:250.000 and 1:400.000. A hydrography map of the Sava river basin was scanned and georeferenced and printed on the same scale. Also a hydrography map and the PELCOM land – use map were printed at similar scales.These maps were the information used for the exercise on ecological network assessment.
- The lack of progress on the agreed activities was discussed; a problem with the sending of the data is in the lacking of a formal agreement how and when to use these data. The agreement to use them only in this workshop was not good enough. This also hase consequences for setting up databases.
- An exercise was done on species selection and the identification of habitat and assessment of coherence of patches was done on "oxbows, (fishing) ponds and wetland areas" and "wet grasslands". The method used and (intermediate) results are discussed in the next paragraph.
- An inventory is made of all major threats to the selected ecosystems in regard of ecological network and network development. A prioritisation of threats is made for the different countries (see Table 2).

- If the maps at this moment would become available, they can not be used anymore in the framework of this PfW-project. It is only in the ensuing (PIN-MATRA) project that the maps will be used, and be crucial once more. The implications and use of maps in the new project are not clear, and therefore the new agreement can not be prepared yet. It should, however, receive the highest priority, immediately at the onset of the PIN-MATRA project!
  Agreed is to propose and implement a suitable infrastructure as far as possible, for the exchange of data among the partners. The LANDSAT imagery will be the only data that can be included in this infrastructure. Data collection can not be part of this project, as an agreement will be required for this.

Table 3 Threats for riverine habitats identified by the participants during the workshop.

Threats	Croatia	BiH	S-M	remarks
illegal deforestation	x	X	X	
legal deforestation/ non sustainable forest management	x	X	X (2)	
drainage for agricultural practices/ increase of agricultural area	x	X (3)	X (3)	
hydrotechnical developments (power plants, stream straightening, damming)	X (2)	X	x	Also in Slovenia a (transboundary?) threat for nature
pollution / eutrophication (waste water, agriculture, industry)	X (1)	X (1)	X (1)	
land abandonment	X	x	x	
urbanization	X	X	X	
lack of ecological data	X (3)	X (2)	X	

X = important threat
X = less important threat
(1), (2) or (3) = importance of threat for habitats; herewith, nr. 1 is the largest threat.

- In the evaluation of, a.o. this workshop, which is held the next morning the following appeared. An interpretation of the evaluation:
  - Project was (too) ambitious, and in the beginning not so clear.
  - The participants gained a good understanding of the approach of ecological networks. The method is supported, and is seen as supplementary to the approach that is used in Slovenia and Croatia. However, to be able to apply it to the Sava area, choices on sites and species still have to be done, adjusted to the specific situation.
  - They gained the insight that gathering data on a proper selection of species in a large number of sites along the Sava can be more efficient and informative than gathering data on many species for a limited number of sites.
  - The participants felt more the urge of transboundary cooperation and are clearer about priorities: exchange of data and tuning of monitoring methods. Also the need to prepare an agreement in the next project for the exchange of data was felt very clear.

- The participants have gained insight in the selection criteria for species and are able to adapt them, cut to their situation, and select a good set of species for mapping.
- The participants realised that there are many areas that they have no knowledge of, which appear very valuable from an ecological point of view. One of them, Spačva, is transboundary (Croatia, Bosnia-Herzegovina and Serbia-Montenegro). This large, crossborder area could be a good area to start transboundary cooperation on inventories, tuning of methods and exchange of data.

3.5 Results of the exercise "assessment of ecological networks along the Sava"

The following steps were proposed to develop an ecological network:

- inventory of available and existing data
- selection of priority ecosystems
- selection of focal species
- data compilation of focal species in database
- map collection of ecosystems/land use in GIS
- analysis in a workshop of existing maps and species data to identify core areas
- drawing of the ecological network, in a workshop, with specialists involved.

As indicated in the approach, the important wetland and grassland habitats were selected in the joint workshop in Sarajevo.
On the basis of a map, compiled from Landsat TM images, participants defined the important wetland and grassland areas. On the basis of some more detailed maps for Croatia, Serbia and Bosnia the exact location of these wetlands was assessed. Complex wetland areas were excluded, and only open water like oxbows, ponds, lakes etcetera, with surrounding reed lands or helophytic vegetation was indicated by marker on film. For grassland areas, an estimate was made of the percentage of grassland cover, since these are always in complex with forest, fields and scrubland, and are not well to determine on the basis of the Remote Sensing image. The result of this exercise is shown in Figure 4. The indicated areas were digitized (Figure 5, Figure 6).

Figure 6: Result of wetland and grassland assessment, drawn by experts on film

Next, focal species were selected for wetlands. A gross list of species for the assessment of ecological networks along the Sava had been prepared by Alterra in advance, based on the following criteria:

- characteristic species for selected ecosystems
- in particular bird and amphibian species (groups selected first workshop)
- available knowledge of species
- species of indicator value for riverine ecosystems
- knowledge available on habitat selection and other spatial characteristics
- distribution and range of species

The resulting list of ca. 20-30 species (Appendix 6) was checked on their presence in the three Sava river basin countries with the experts present in the workshop. Notes were made if the species is protected nationally or included in the Habitat or Bird's directive. In addition some species, which are considered very characteristic for the Sava, the Black and White stork, were added by participants.
Not all wetlands were well known by the experts present, and in general it was difficult to confirm the presence of species in those areas. Some areas are very remote, or difficult accessible.
Based on these results, 4 wetland species were proposed for further network assessment in this workshop (Table 4).
The same process was repeated for grasslands. A pre-selection of suitable wet-grassland species was made by Alterra and presented here (Appendix 7). This list was considered by the participants; per species is indicated in which countries it is occurring in the Sava, as well as its listing in the annexes of the Habitat and Birds directive. Included was/were also the Green toad and Yellow-bellied toad as

indicative for the Sava River. Based on these results, grassland species were proposed for further network assessment in this workshop (Table 5).

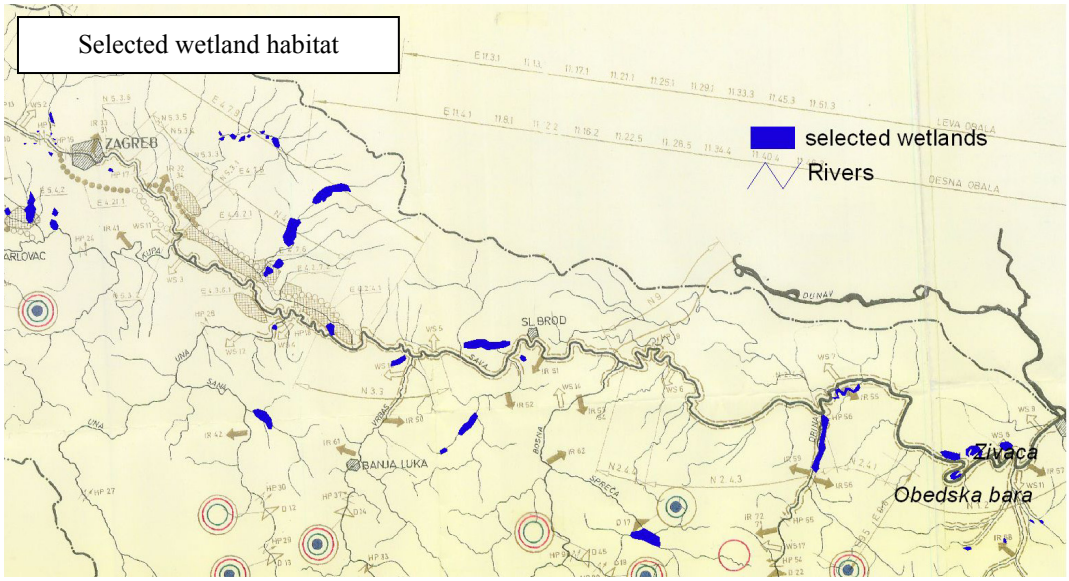


Figure 7: wetland areas of importance for the ecological network of the Sava river basin; note that Lonsjko Polje is considered mainly as grassland ecosystem by workshop participants

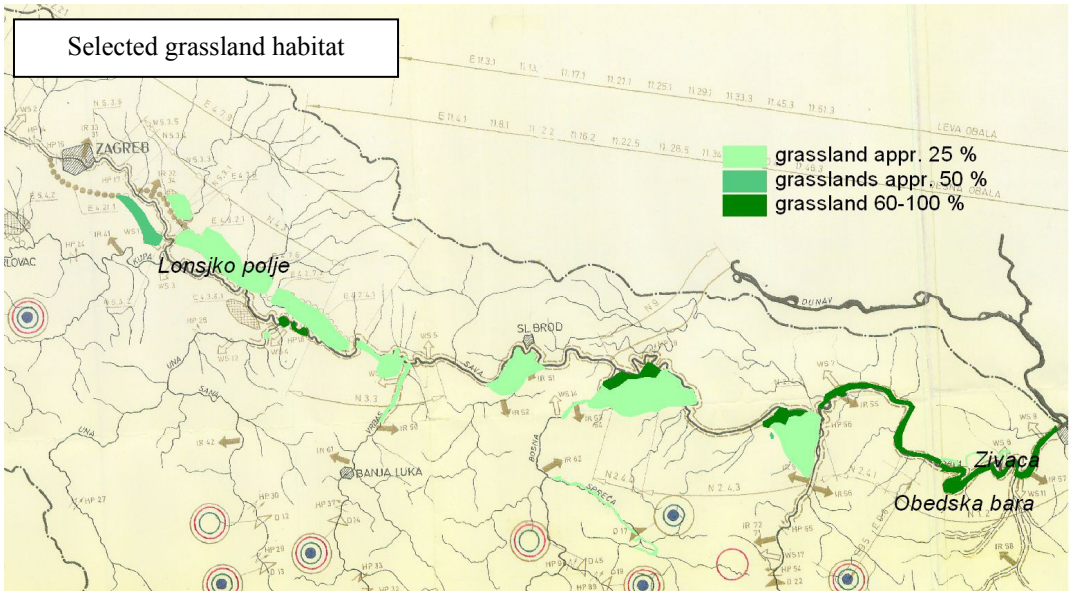


Figure 8: grassland areas of importance for the ecological network in the Sava river basin

Table 4 Selected species for the assessment of ecological networks of wetland areas.

Disp. Range (km)	English name	Scientific name
0 -- 3	European tree frog	*Hyla arborea*
7-15	Bluethroat	*Luscinia svecica*
25 - 35	Bittern	*Botaurus stellaris*
	Otter	*Lutra lutra*
	Black stork	*Ciconia nigra*

Table 5 Selected species for the assessment of ecological networks of wet grasslands.

Disp. range (km)	English name	Scientific name
0-3	Green toad	*Bufo viridis*
3—7	Large copper	*Lycaena dispar*
7 –15	Yellow-bellied toad	*Bombina variegata*
15-25	Badger	*Meles meles*
> 35	Barn owl	*Tito alba*

The important wet grasslands and wetlands were assessed on its potential population for the selected species. Based on known carrying capacities, or densities of species (known from the database of Alterra, and verified or adjusted based on expert knowledge of biologists present in workshop), and the size of the selected area, it could be assessed what the potential wildlife population is for each of the selected areas. For species with large area requirements some areas may be too small, and therefore have no significant role in the ecological network as e.g. reproduction habitat. Species with small habitat requirements though are likely to be widespread in most of these areas. The areas were classified as either suitable for a Minimal viable population, as core area (key area) or as smaller area or stepping stone. This classification was based on the potential population of the selected species.
Next, for each of the ecosystem types (i.e. grasslands and wetlands), it was assessed whether the dispersal range of the species and the distance between the important areas do match. In other words, whether the areas are functionally within reach for the considered species.
Based on this data it is possible to pinpoint the areas which are very important for a network of a species, e.g. for its role in connecting major populations. Important populations in Lonsjko Polje and Obedska bara can be separated if there is no suitable habitat of required size within the dispersal range of a species. The design of the ecological network should take these factors into account, in the proposed protected area and corridor network.

Verifying the results with distribution data, a striking difference was found for a species such as the Bittern (*Botaurus stellaris*). Although the wetlands are still present, and of required size in Croatia, the species is known to be absent from most of the areas along the Sava river; only around fish ponds along tributaries the species is still present. This is due to the quality of the reeds, and the absence of management. This underpins first of all the importance of the availability of distribution data (and in this case reasons for its decline), second it shows the importance of the wetlands along the Sava for the ecological network of a species like the Bittern. With further

destruction of these wetlands the species is not likely to survive in the small wetlands and fishponds along the tributaries.

3.6 Combining nature protection and safety against flooding along the Sava

3.6.1 Importance of ecologically functioning riverine floodplains

Riverine floodplains are characterized by high biodiversity and productivity, and corresponding recreational and aesthetic values. The floodplains are very productive landscapes, as a result of continual enrichment by import and retention of nutrient-rich sediments from the headwaters and lateral sources; even more productive than the parent river and the adjacent uplands (Tockner & Stanford, 2002).
Floodplains are among the most altered landscapes worldwide and they continue to disappear at an alarming rate, since floodplain 'reclamation'/'elimination' is much higher than for most other landscape types (Olson & Dinerstein, 1998; Ravenga *et al.*, 2000). The result is a vast constriction of floodplains, sometimes by more than 50% of the historic area (Snyder *et al.,* 2002), and a large decline in biodiversity of fresh water and floodplains (Tockner & Stanford, 2002).
Formerly the Danube had 26 000 km^2 floodplain area along the Danube and its major tributaries. However, 20 000 km^2 was separated by levees and have therefore become "functionally extinct, which means that the basic attributes shat sustain the floodplain such as regular flooding or morphological dynamics are missing" (Nachtnebel, 2000). Although a high biodiversity still can be observed in many regulated floodplains, this has to be considered as a relict of former conditions, since the developments in the floodplain area can be slow but will finally lead to a decrease in diversity and shift in community composition. For sustainable functional floodplain over the long term, many efforts are required, a.o. by restoring hydrological dynamics, creating floodplain natural areas and riparian green belts along the entire corridors of rivers (Tockner & Stanford, 2002).

3.6.2 Preview on combining measures of nature protection and safety against flooding along the Sava

Flood prevention and nature values can go hand-in-hand
In the framework of this project, the relationship between flood retention, nature development and water quality in Lonjsko Polje, a 237 km^2 retention area along the Sava in Croatia, is studied (Baptist *et al.*, in press). Lonsjko Polje has very important river-related ecological values, at local, regional, national and even at global scale (Ramsar site). Characteristic for the retention area is a traditional grazing management system with indigenous breeds of cattle, horses and pigs, and forestry, hunting and eco-tourism.
This area is a key site to lower peak discharges in a large part of the Sava river and is an example of how floodplains decrease flood waves. These large alluvial floodplains were preserved in the seventies as detention areas. This system has proved to be well

designed and functioning since over 30 years and at the same time has maintained the ecological and cultural heritage of the region (Schneider-Jacoby, 2003).

Discussion of potential of indicated areas for nature and flood protection
In a meeting with Mrs. Ellis Penning from WL|Delft Hydraulics the results of the exercise are discussed and evaluated. However, as these results are preliminary and not complete, this can not be discussed into depth.

In and in paragraph 3.5, the areas that are thought to be wet grassland or wetland are indicated. Many of these areas are enclosed by dikes and therewith lost the original flooding regime of the river. However, owing to extensive land use the natural values of floodplain areas have (partly) remained or may be easy to restore.

The area near Slavonski brod seems very important for flood retention, because it is just downstream of the confluence of the tributary Vrbas and Sava, just upstream of the city of Slavonski brod. With coinciding flood peaks of the Sava river and the Vrbas tributary, this area can be used to level down the peak discharges in Slavonsky brod.

The Spacva area is situated downstream the confluence of the Bosna tributary and the Sava river. Also this area can have a function in levelling down (coinciding) peak discharges. Further, this seems a large scale farming area, and is strategically situated in between Lonsjko Polje and Obedska bara, two of the areas most known for their nature values. For the ecological network Spacva may contribute largely to the ecological coherence of these two areas and to the persistence of occurring populations. It can function as a large key area for species as Bittern, Purple Heron, Black stork, Barn owl, Otter and Beaver in the ecological network in between the potential key areas of Obedska Bara and Lonjsko Polje. The presence of key areas strongly increases the stability of a population of species in a metapopulation and the persistence of a species on the long term.
On the confluence of the Drina and Sava also a large former floodplain is situated. Rehabilitation of the floodplain will have a positive effect on the flood protection downstream, where Beograd is situated.

However, the likelihood of coinciding flood peaks and the threat for built up areas is not known. Modelling of the discharges of the Sava and its tributaries and the probability of flooding of built-up areas could be subject of a hydrological study in future. This could quantify the effect of the development of (nature) areas for flood protection, and a prioritization could be made for restoration areas.

3.7 Design of and implementation of a Spatial Data Infrastructure

During the workshop of 4th and 5th of April it has been agreed upon between the representatives of different research institutes of the Sava river basin countries that transboundary river basin management is a laudable goal, but that the establishment of a Sava river basin wide GIS is not feasible under the present conditions.

More feasible seemed the design and implementation of a spatial data infrastructure (SDI) by means of which all the institutes that are involved in the present project (and follow up projects) are able to exchange metadata and/or data. By means of this SDI an overview can be presented to the Sava Commission of all the datasets that are available at different institutes in the Sava river basin countries. Depending on the user restrictions of the datasets the data can be made available as well to the Sava Commission for the purpose of transboundary river basin management. Depending on the user needs different web services can be offered as well to the Sava Commission that make it possible for the Sava Commission to use spatial information related to different topics amongst others biodiversity for in the river basin management plan.

During workshop 1 (availability of data) it was agreed upon that the State Institute for Nature Protection in Croatia is the most appropriate institute to be involved in the design, the implementation and maintenance of such a SDI as this institute has the proper expertise and knowledge and because the Sava river basin (catchment area) has the largest area in Croatia. This agreement was made under the conditions that all datasets that are being collected (and free available) or datasets that are derived from other datasets within the present project (e.g. a proposal for an ecological network for the Sava River Basin) should be made available for all project participants. For this purpose agreements should be made in the future between all the institutes involved (also in follow up projects) and the Sava Commission on use of datasets and maintenance of the web application and web server.

A delegate from the State Institute for Nature Protection in Croatia has been visiting the Centre for Geo Information of Alterra 21st - 22nd June 2005 in order to design and implement a spatial data infrastructure for the Sava river basin. A web application has been realized making use of the Open Source Geo Network software (http://geonetwork.sourceforge.net/ (Figure 9, Figure 10, Figure 11) . It includes a metadata catalog, a metadata search engine, an interactive map viewer and an online metadata editor. The Sava SDI is accessible for all participants through the Internet. The Sava SDI is based on open standards adopted by INSPIRE (The INfrastructure for SPatial InfoRmation in Europe, http://www.ec-gis.org/inspire/), such the OpenGIS standards (Webmappings services, web catalog services) and international open standards for metadata (ISO19115).

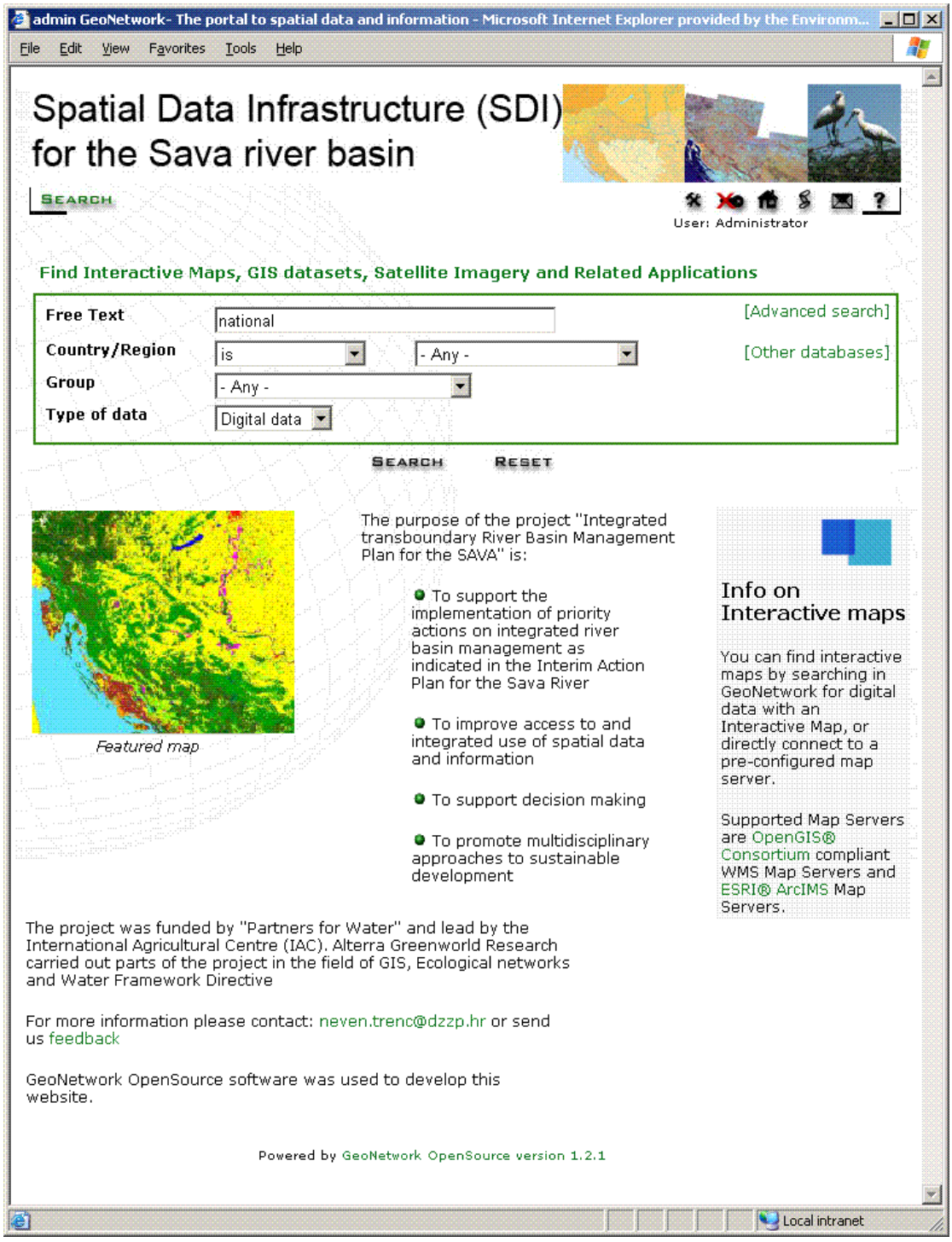


Figure 9 Main page of the Sava SDI prototype.

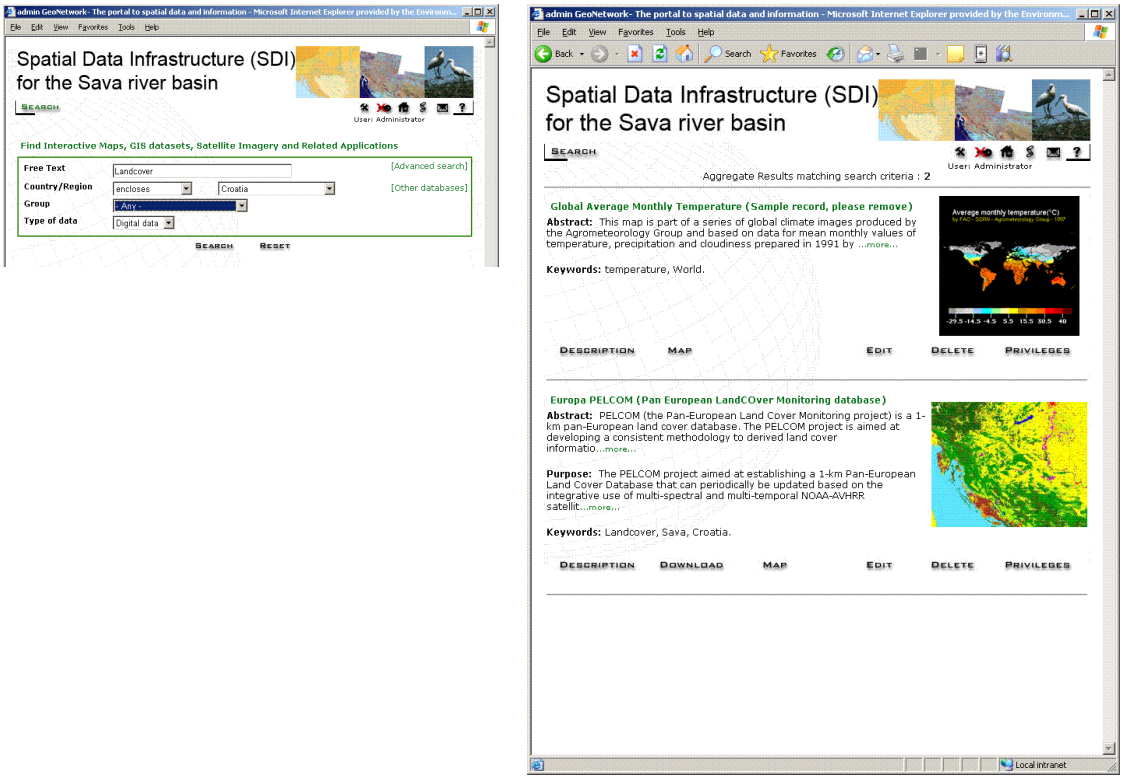


Figure 10 Sava SDI prototype Search Engine and results

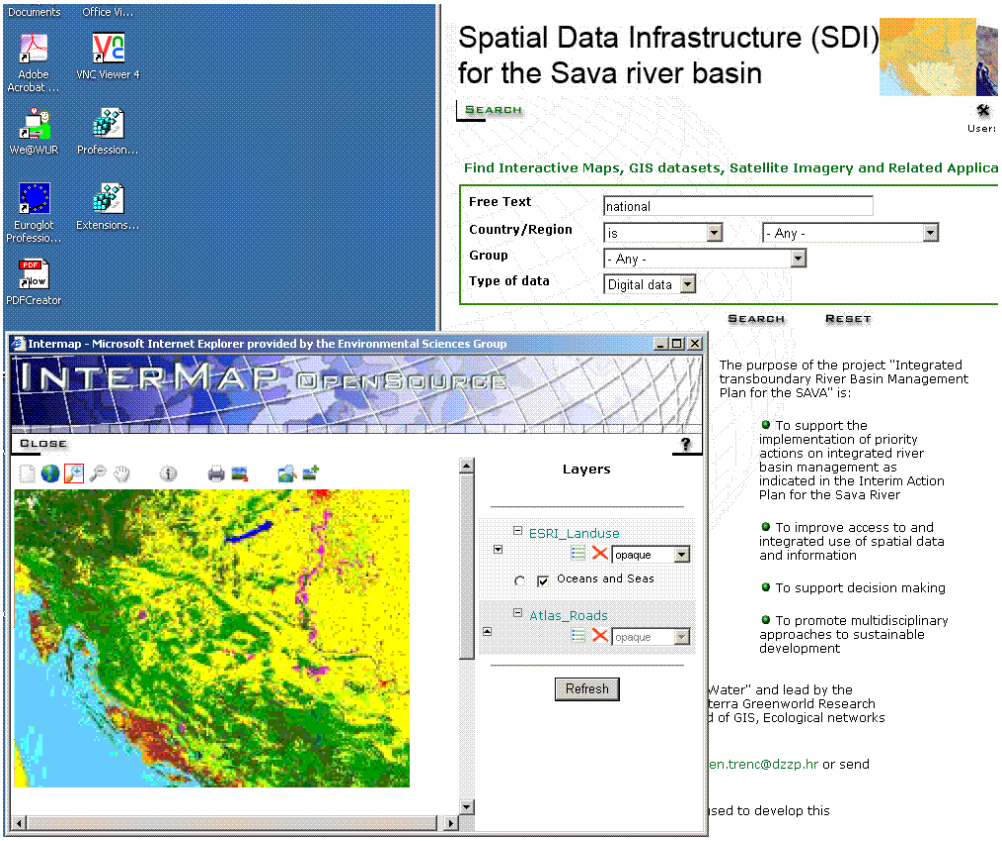


Figure 11 The Sava SDI Mapviewer in action.

The Sava SDI will be hosted by the State Institute for Nature Protection in Croatia and be run on a dedicated server that was purchased as part of the project. The internet application will be made available to all participants so all participants can contribute metadata, search for available metadata, view or download available data in accordance with agreements made with owners.

In September 2005, an expert from Alterra on Geo Information will visit the Institute in Croatia for the implementation of the spatial data infrastructure. This visit was scheduled earlier, but was postponed because of the required time to arrange the costume formalities required for the import of the server in Croatia.

3.8 Inventory of datasets

In Table 6, an overview is presented of the datasets that are available of the different Sava river basin countries at different levels (Global, European and national. In Appendix 8 the metadata of the Global and European datasets is given. Of the national datasets the metadata is/or will be made available through the spatial data infrastructure developed in the present project. The overview of the national datasets is incomplete as only a few institutes have been asked to indicate the data they own.

Table 6 Overview of spatial datasets available for the Sava river basin countries

Spatial data component	Global datasets	European	National
Geographic location			
Geodetic reference system			In the present project it has been decided to use Gauss Kruger projection system zone 5 as this projection system is being used by all Sava river basin countries
Administrative units			
Country borders	Digital Chart of the World 1:1000.000	Bartolomew map 1:1000.000	?
Elevation			
Digital Terrain Model	USGS GTOPO30 Digital Elevation Model	Elevation Europe Images	?
Biota/biodiversity			
Biogegraphical regions		Biogeographical regions, Europe 2001	
Habitats			CORINE biotopes (habitats) 1:100.000 Available for Croatia
Species distribution			Different type of maps are available, but incomplete and not all in digital format.
Land surface			
Unclassified satellite images			Landsat TM images Available of all Sava river basin countries
Landcover	Global Land Cover Map 1:1000.000	PELCOM 1:1000.000	CORINE 1:100.000/1:250.000, Available for Croatia and Slovenia
Area regulation			
Protected areas			Available for all Sava river basin countries (except Serbia?)
National Ecological Network			Available for Croatia and Slovenia

3.9 Gap analysis of spatial datasets

Geographic location

Geodetic reference system
In the present project it has been decided to use Gauss Kruger projection system zone 5 as this projection system is being used by all Sava river basin countries.

Administrative units

Country borders
At Global and European level datasets on the country borders of the Sava river basin countries are available. The Digital Chart of the World (http://www.maproom.psu.edu/dcw/) is for free. The Bartolomew map is not for free (http://www.bartholomewmaps.com/europe_data_products.htm). So the country borders have been derived from the DCW. For the purpose of the transboundary Sava river basin management more accurate data on the country borders is needed. It's not clear if these data are available of the Sava river basin countries (at national level), but most probably they are.

Elevation

Digital Terrain Model
At European level a Digital Terrain Model DTM is available (http://dataservice.eea.eu.int/dataservices/), but this dataset isn't accurate and detailed enough for the purpose of the Sava river basin management. In the future there will be a more detailed DTM availabe based on remote sensing images (http://glcf.umiacs.umd.edu/data/srtm/) that might be used.

Biota/biodiversity

Biogeographical regions
A European datasets is available of the biogeographical regions of Europe. This maps is usefull amongst all in the framework of Natura2000.

Habitats
A national dataset on habitats is available of Croatia (scale 1:100.000). Of other Sava river basin countries there are no databases available on habitats covering the whole country, but just of specific areas. Habitats might be partly derived from land use databases and or satellite data (e.a. Landsat TM).

Species distribution
Different datasets are available, but often incomplete, out of date and partly based on expert knowledge. Arrangements should be made on the use of these national datasets. Actual data on the distribution of threatened and protected species in the Sava river basin countries is needed partly within the framework of Natura2000. There is a lot of information on species already collected but not all of this

information is available in databases. A lot of work has been done, but a lot of work is still to be done in the future (e.g. collection of data in the field).

Land surface

Landcover
At global level the Global Land Cover Map is free available and downloadable from the web (http://www.geog.umd.edu/landcover/1d-map.html). These data have been downloaded and transformed into Gauss Kruger reference system. At European level the PELCOM database is free available and downloadable from the web (http://www.geo-informatie.nl/projects/pelcom/). These data have been downloaded and transformed into Gauss Kruger reference system. At national level datasets on land use are available of three Sava river basin countries namely Croatia, Slovenia and Bosnia. Arrangements should be made on the use of these national datasets. Different land use classification systems have been used (ao. CORINE classification system).

Unclassified satellite images
Landsat TM are free available of the whole catchment area of the Sava and downloadable from the web. These datasets have been downloaded, imported in a GIS (img format) en transformed into Gauss Kruger reference system.

Area regulation

Protected areas
Datasets are available of all Sava river basin countries, however, the dataset of Serbia was under construction. Arrangements should be made on the use of these national datasets. Croatia and Slovenia have indicated Natura2000 sites within the framework of the European Bird directive and Habitat directive.

National Ecological Network
Datasets are available of the national ecological networks of Croatia and Slovenia. Arrangements should be made on the use of these national datasets.

Agreements should be made between the different institutes that own the datasets and the Sava Commission in order to be able to use the datasets for the purpose of Sava river basin management. As the Sava Commission was not installed yet these agreements could not be made within the present project. This means that only free available European or Global datasets have been collected. These datasets in general have a scale of 1:1000.000 which is not suitable for applications on a national or regional scale except for the Landsat TM images (resolution 36 m^2, scale 1:100.000).

3.10 Metadatatool on available information on the Sava river basin

The metadata that were collected by the institutes from Serbia-Montenegro and Bosnia-Herzegovina were entered in a digital metadatatool, that was made available through the internet. This metadata tool was adapted to the specific requirements for

this data inventory. It will be public accessible through the internet, as the institutes will put the link on their websites. Initially this metadatatool will be available at the following website: http://webgrs.wur.nl/cgi/projects/sava-metadata/. When the spatial data infrastructure is functioning, the metadata tool will be put on this server.

3.11 Project proposal for gathering of ecological field data

Based on the discussions on required ecological field data and theories and methods that were passed in the workshops, the Bosnian Institute CEPRESS drew up a project plan for the transboundary gathering of field data. This project plan is presented in Appendix 9.

4 Discussion

4.1 Suitability of and cooperation with involved institutes

4.1.1 Suitability and competence of involved institutes

The institutes that were involved in this project appeared to be very competent and the best suitable partners in the Sava river basin countries. In all countries the competence ecology and ecological data was relatively high, measured to the level of data that is available in the countries.
The Center for Ecology and Natural resources in Bosnia-Herzogovina institute appeared to have knowledge on the entity of the federal state of Bosnia-Herzegovina only and lacked knowledge on the territory of the Republica Srpska. Also they did have no capacity on GIS. This gap in knowledge and capacity was solved by cooperating with the Agrocultural Institute, that is located in the Republica Srpska. This institute has much experience with GIS and has relevant datasets (e.g. land cover) to its disposition on both entities of Bosnia-Herzegovina. The institutes have cooperated fruitfully in this project and have indicated that they intend to increase this cooperation in the field of ecology and GIS.

In the field of GIS and data management, the institutes of Slovenia and Croatia are very advanced. Also the Agricultural Institute in the Republica Srpska is very experienced in GIS. At the institute from Serbia-Montenegro, staff members have just been trained to use GIS. It is planned to digitize many geographical information next years.

All of the involved institutes had little data available on hydrographical data and data that are related to water management. These data were under the competence of national water management institutes. To get access to these data appeared to be difficult and time consuming.

4.1.2 Cooperation with and between institutes

Despite of a cooperative attitude of many of the delegates of the institutes, the cooperation with the involved institutes was not always optimal. Focusing on geographical and ecological data of the Sava river basin and the development of an ecological network along the Sava was not an issue that arose at these institutes itself, as the involved institutes were invited to participate and contribute to this project. Therefore the issues of geographical data exchange and management and ecology in the Sava river basin have not the highest priority for most of the involved institutes. Also most of the institutes were busy with other tasks (e.g. N2000, ecological monitoring) that were given higher priority on the level of the institutes.
However, the delegates of the institutes supported the importance for future transboundary cooperation on the Sava river.

4.2 Available geographical and ecological data

There appeared to be large differences in data availability between the Sava river basin countries; In Slovenia and Croatia many geographical and ecological data are available, in Bosnia-Herzegovina and Serbia-Montenegro only few. Also in these latter countries no overview existed on available data. As a result of the war, many data have been lost. To reduce the gap between the countries, the focus should be on increasing the level of data and data infrastructure in particular in Bosnia-Herzegovina.

In Bosnia-Herzegovina and Serbia-Montenegro, but also in Croatia, very little ecological field data as distribution data are available. Also often data are available of a limited number of sites, whereas of sites that seem ecologically valuable, no data or knowledge is available.
To be able to assess, saveguard and improve the ecological networks along the Sava river, field data on the distribution of species and the area and quality of habitat are required in the countries mentioned. Important is to make sure that the data inventory takes place in all potentially ecologically valuable areas along the Sava the tributaries. For the selection of species and of habitats of interest that should be monitoring, the approach of focal species and of habitat mapping that is presented and applied in the framework of this study can be used. Also, the choices of habitat types and species of interest in the Sava river can be a good starting point for gathering field data.
Choices in habitats and species and methods should be carefully tuned between all Sava river basin countries, to guarantee that the data that are collected are compatible and suitable for a transboundary evaluation. The project proposal that is made by the Bosnian Institute is a suitable point of departure for setting up a transboundary inventory of ecological data.

To be able to collect and collate the required geographical data of the Sava river basin countries, an overview has been created on the available data. Also an overview of available European and Global datasets has been made. These latter datasets can be used as a fall back option, if detailed information on a subject (e.g. land cover) is not available in one of the Sava river basin countries. Also the Landsat TM satellite image that is downloaded and georeferenced in the framework of this project can be used for this purpose. However, the data overview is not complete yet, and also data that are owned by the national water management authorities are not inventoried yet. The filling of the metadata tool however can be an ongoing process, as it can be filled trough the internet.

In the workshop 1 on data inventory, a first selection is made of data sets on land cover, habitats and species that seem to be matching best, and seem suitable for the assessment and improvement of the functional ecological networks in the Sava river basin (see appendix 2). The collection and collation of these data should be realized as a next step towards the design of an ecological network. To realize this, a spatial data infrastructure is designed, purchased and implemented. Important is now that the institutes of the Sava river basin countries come to an agreement on the exchange of data and the restrictions for usage of data.

When the required agreements between the institutes are made, spatial data can be exchanged and combined to Sava basin wide maps. These are required by the Sava river basin commission for the integrated transboundary management of the Sava River basin. To enable the Sava Rvier basin commission to get the required data to its disposition, Arrangements between the data holders including official agreements between governments should be made on the use of the datasets by the Sava commission for the purpose of the Sava river basin management. Also, Arrangements have to be made between the Croatian institute with the Sava Commission on the maintenance of the SDI that has been implemented in the present project
Further, the publishing of data by different institutes in the Sava river basin countries should be stimulated and additional web services should be developed depending on the user requirements of the Sava Commission and participating organizations.

4.2.1 Preliminary choice of habitat types and species

Choice of habitat types
The choice to focus on "Wet grasslands", "Oxbow lakes, ponds and open water" and "Alluvial forest; hardwood forest / softwood forest" is supported by a figure presented in Brundic *et al.* (2001; Figure 12). In this figure is shown that most diversity of bird species, and of endangered species are observed in wet pastures and meadows, ponds, oxbow lakes and hardwood forest and alluvial forest, especially hard wood forest.

Choice of species for gathering of field data
A preliminary choice on focal species for the assessment of functional ecological networks of "Wet grasslands", "Oxbow lakes, ponds and open water" has been made. It is advisable to consider to select these species for the gathering of field data in future projects (or species on the grosslists in appendices 6 and 7). Obtaining an overview of the distribution of the breeding spots of these species should be very useful in the assessment and improvement of the functional ecological networks in the Sava river basin and the design of an ecological network that has political importance. Further, species and habitats that at are under the protection of the Birds and Habitats Directive should be considered, as the condition of the population of these species have a larger political impact than other species. Also the indicator species that are selected as biodindicator results for the Sava river in the WWF study in the framework of the Danube Pollution reduction programme should be considered.

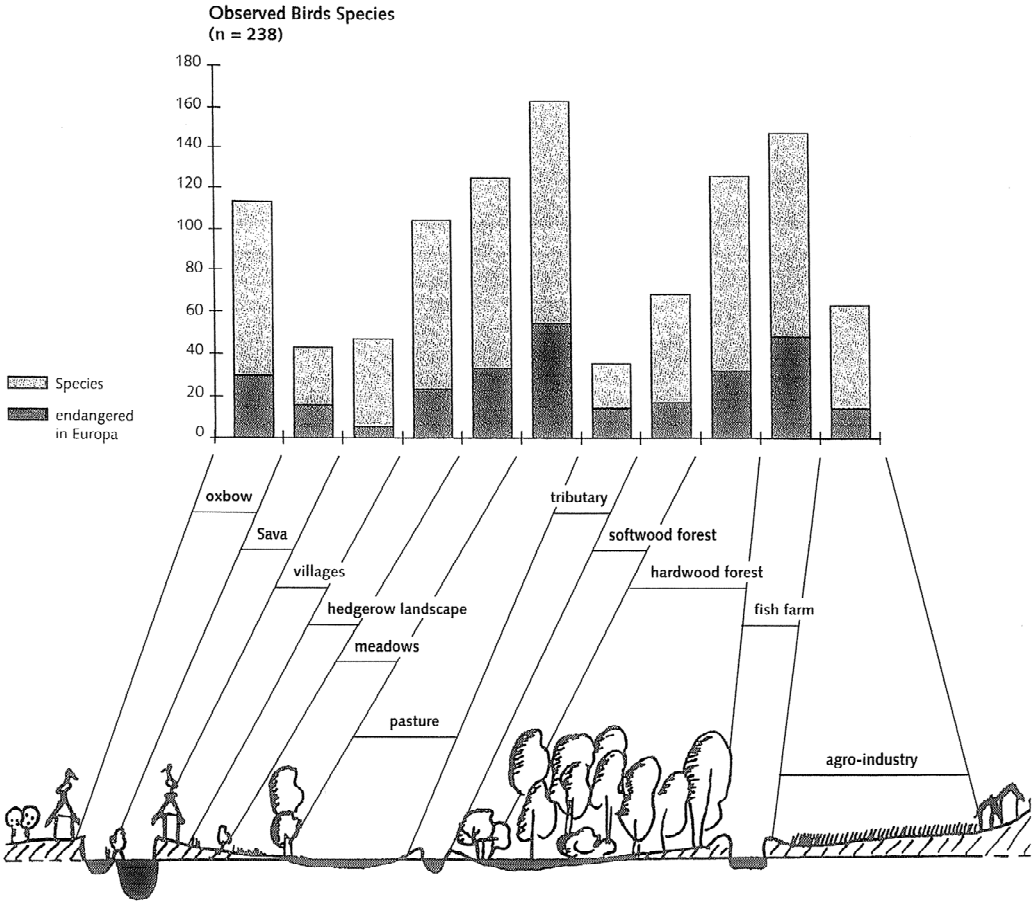


Figure 12 Birds as indicator of the ecological importance of alluvial wetland. Most species have been observed in the large pastures characteristic for the alluvial depression in the Central Sava river basin (Schneider-Jacoby, 1993; from Brundič et al., 2001).

4.3 Conclusions and recommendations

- **Cooperation:** If the cooperation on transboundary management and exchange of ecological data and data analyses between the Sava river basin countries should be continued and intensified, political pressure is required to put the issues address higher on the priority list of the institutes involved.
- **Inventory of datasets**: to complete the data inventory and exchange and collate data, required for integrated river basin management, also relevant data at the national water management institutes in the Sava river basin countries should be inventoried and considered. Here for, cooperation between the national institutes on nature and on water management should be stimulated.
- **Inventory of datasets**: Arrangements between the data holders including official agreements between governments should be made on the use of the datasets by the Sava commission for the purpose of the Sava river basin management. For the follow up projects it is recommended to give high priority to making these arrangements.

- **Spatial Data Infrastructure:** Arrangements have to be made between the State Institute for Nature Protection in Croatia to agree with the Sava Commission on the maintenance of the SDI that has been implemented in the present project. It is recommended to give also high priority to making these arrangements with the State Institute for Nature Protection in Croatia and the Sava Commission.
- **Transboundary cooperation**: Publishing of data by different institutes in the Sava river basin countries should be stimulated and additional web services should be developed depending on the user requirements of the Sava Commission and participating organizations.
- **Ecological networks**: For the gathering of field data, the approach of ecological networks and the decisisons made on species and habitats of interest made is this study can be used for an efficient gathering of data that can be used for the design of an ecological network.

4.4 Recommendations, related to the Action programme of the ICPDR

4.4.1 On the action programme of the ICPDR

This action programme is agreed on and adopted in December 2004 by the International Commission for the Protection of the Danube River Basin (ICPDR, 2004). The overall goal of the Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. The action programme represents an overall framework which needs to be specified in further detail for sub-basins, a.o. the Sava river basin. For an abstract of the content that is referring to the use of natural retention areas, see **Box 5**.
In 2009, a document on sub-basin level is scheduled to be finished by national institutions or international bodies as the Sava River Basin Commission.

From the action programme, it can be concluded that the use of natural retention areas (flood plain areas) for *long-term flood protection and retention strategy, based on the enhancement of natural retention* is high on the agenda of the ICPDR. As a result, it will also be high on the agenda in the flood action plan, that has to be delivered at the end of 2009 by the Sava River Basin Commision.
Also important to notice is that the ICPDR promotes to manage these natural retential areas in an environmentally sound way.
Further, transboundary cooperation on flood protection is found very important. And in the required measures that are mentioned for the sub-basin flood action plan, a sound GIS with data on abiotic and biotic features of the landscape and topographic and administrative data are indispensable.

Box 5 Abstract of content of the Action Programme for sustainable flood protection in the Danube River Basin, related to natural retention (ICPDR, 2004)

Underlying principles and objectives for sustainable flood protection for the Danube river basin are:

- The risk of Floods, which are a natural event along rivers, is increasing and will further increase, as a result of human interventions and of climate change.
- The proposed general approach is to make trans-national effort to restore rivers natural flood zones, in order to reactivate the capacity of natural wetlands and floodplains to retain water, alleviate flood impacts and mitigate negative consequences such as contamination.
- Further it is stressed that transboundary coordination is required as local flood protection measures can have negative effects both downstream and directly upstream.

In the action programme, three scopes of future action are determined, namely: natural retention, structural flood protection and the reduction of hazards.

Based on that, Danube river basin wide targets are set. These will be worked out in separate guidance documents for sub-basin flood action planning. For the sub-basin flood action planning, six targets are set. The first target mentioned is: "*Development and implementation of a long-term flood protection and retention strategy based on the enhancement of natural retention as far as possible*".[1]

In the programme, a guideline is presented on the content of the flood action plan of sub-basins. On the development of a retention strategy the following measures are mentioned:

Regulation on land use and spatial planning to preserve natural retention

- assessment and changes of current land-use patterns.
- Promoting environmentally sound forest management, agricultural practices and landscape management
- Finding retention possibilities as decentralized and as far upstream as possible
- Mutually agreed extent of protection versus retention
- Involvement of existing wetlands and extension of those where apporproate.

Reactivating of former, or creation of new, retention and detenion capacities by:

- Restoration of natural courses of tributaries and their overflow area
- Detention along the tributaries and rivers, creation of polders, dry flood reservoirs or multipurpose reservoirs with flood retention capacity
- relocation of flood embankments
- partial reactivation of protected flooplains applying controlled inundation.

[1] Other sub-basin-wide targets mentioned are:

- Improve flood forecasting and early warning
- increase capacity building and raise level preparedness for flood mitigation
- to develop flood maps
- harmonize design criteria and safety regulations along and across border sections
- prevent and mitigate pollutions of water caused by floods

Capacity building, raising preparedness of the organizations responsible for flood mitigation.

The flood action plans for sub-basin are scheduled to be finished at the end of 2009. The competent authorities for preparation and implementation of the action plans are:

Country	Name of institution	Address
Bosnia-Herzegovina	Federal Ministry of Agriculture, Water Management and Forestry environment Ministry of Agriculture, Forestry Environment and Water management	Marsla Tita No 15 Sarajevo, Bosnia and Herzegovina Bijeljina, Bosnia and Herzogovina
Croatia	Ministry of Agriculture, Forestry and Water Management, Water Management Directorate	Ulica grada Vukovara 220, 100000 Zagreb Croatia
Serbia-Montenegro	Republic of Serbia Ministry of Agriculature, Forestry and Water management Directorate for Water	Bulevar umetnosti 2a 11070 Novi Beograd
Slovenia	Ministry of Environment Spatial Planning and Energy	Dunajska 48 SI-1000 Ljubljana Slovenia

4.4.2 Conclusions and recommendations

Based on the content of the action programme and the situation in the Sava river basin, we conclusions can be drawn:

- Floodplains are (recognized as) the most suitable areas for retention and storage of water. They should therefore be planned as much as possible in line with this function. This means that floodplain development in which permanent structures are build should be avoided at all costs (e.g. houses, infrastructure). This in order not to thwart the strategy for flood protection of the ICPDR.

- The ICPDR states that allowing natural flooding processes in floodplains and retention areas are most desirable to reduce peak flows. These same processes are also required for a ecologically functioning floodplain area and a sustainable biodiversity of riverine habitats. These functions are therefore extremely well compatible and can be mutually reinforcing. The compatibility and mutual reinforcement of flood protection and nature protection in flood plains and retention areas along the Sava should be demonstrated very clearly to the competent authorities that are responsible for the drawing up of the flood action plan and the Sava River Basin commission.

- Engage the competent authority that is responsible for Nature conservation/Natura 2000 to seize the opportunity of combining measures for flood protection for nature protection. Seen the fact that floodplain areas can contain high nature values and that these can be safeguarded or promoted by flood protection measures, forces can be joined for the use of (former) flood plain areas for retention areas and designated these areas as N2000 areas.

- Seize opportunities for cross border cooperation and exchange of information in nature conservation, land use management and water management. This will pay off in a tuned and efficient cross boundary nature and water management and better perspectives for an ecologically healthy river basin.

More concrete, the following actions are required for an implementation of opportunities for combined nature and flood protection measures in the flood action plan:

- Mapping of all (potential) retention areas / former floodplain areas in the Sava river basin.
- Inventory of nature values in the Sava river basin, with priority on the pltentioal flood retentiona areas, by tuned gathering of field data along the Sava and its tributaries.
- Evaluation of these ecological field inventories and gathered GIS-data; what are potential N2000 sites in the Sava river basin, especially in (former) floodplains and (potential) retention areas, what is the coherence of nature areas and how can conditions be met for long term biodiversity.
- Hydraulic study on the Sava and its tributaries; What are the discharges, where and in which cases disaster floodings can be expected, and how much retention capacity at what locations are required for a sound flood protection system.
- Integrated evaluation of the results of the hydraulic and ecological study: proposal for flood retention areas and floodplains that are beneficial for both flood protection and nature conservation.
- Capacity building at the competent water management authorities and nature management authorities, to inform them about the opportunities of joint measures for flood and nature protection. This so that the opportunities are understood and can have their effect in the flood action plan of 2009 and in (inter-) national policies.
- Further, environmental impact assessments are required for planned and future projects that have impact on discharges in and land use along the Sava (civil engineering projects!).

Seen the fact that end of 2009 the flood action plan for the Sava should be finished, we recommend that these actions should be scheduled as shown in Table 7. The actions proposed in this table can be carried out partly as a part of planned project, as the PIN-MATRA project "Ecological networks along the Sava", that will run from august 2005 to june 2006. However, he PIN-MATRA project however is too small to be able to address all required actions, or all required field work in these years. Also

other projects that are related are applied for, e.g. a GEF proposal. So another action that we recommend is to evaluate how much funding is available for the required actions, and how if required to find additional funds or to make combinations with national (inventory, GIS) activities.

Table 7 proposed required activites required for the implementation of oppurtunities for combined nature and flood protection measures in the flood action plan, put in a time frame.

year	activities	product
2005	- agreements on the exchange of data by Sava river basin countries - filling of Sava-GIS by Sava-Countries -Identification of (former) floodplains / potential retention areas along Sava and tributaries - set up inventory of selection of species in (former) floodplains / potential retention (tuned, transboundary) - start inventory of selection of species.	- Map of (former) floodplains / potential retention areas - Tuned project plan for required inventories of species in (former) floodplains / (potential) retention areas in Sava river basin countries
2006	- inventory of selection of species in (former) floodplains / potential retention areas; storing data in GIS - start hydraulic study on the Sava and tributaries - filling of GIS - ongoing - Informing of nature conservation competent authorities; lobby for the establishment of link flood protection measures with Natura 2000 / nature conservation - Informing of water management competent authorities; promote the integration of flood protection measures with Natura 2000 / nature conservation	- Interim report inventory of species - Capacity building in / gaining support of competent authorities of water and nature management on the opportunities for linking flood protection measures with nature conservation.
2007	- inventory of selection of species in (former) floodplains / potential retention areas; storing data in GIS - Finish hydraulic study on the Sava and tributaries - filling of GIS – ongoing - lobbying at water management and nature management authorities; ongoing	- Interim report inventory of species - Conclusions hydraulic study; where and how much retention is required - Capacity building in / gaining support of competent authorities of water and nature management
2008	- evaluation of species inventories along the Sava and tributaries; quality of (former) floodplains / potential retention areas for nature - identification of opportunities for retention areas that are beneficial for both flood protection and nature conservation - filling of GIS – ongoing - initiate/facilitate integrated water and nature management by water management and nature management authorities	- report on the ecological values of (former) floodplains / potential retention areas along the Sava - integrated proposal for retention areas that are required and beneficial for both flood protection and nature conservation - Capacity building in / gaining support of competent authorities of water and nature management
2009	- communicate results to water management and nature management competent authorities - facilitate integrated water and nature management approach by water management and nature management authorities	→ **Delivery of flood action plan for the Sava**

4.5 What opportunity offer flood protection measures for biodiversity along the Sava?

A safe Sava river is of big importance for people living along the river. Therefore many measures are required. The ICPDR has recently agreed on an action programme for the Danube river basin (ICPDR, 2004). The overall goal of the Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. The action programme represents an overall framework which needs to be specified in further detail for sub-basins, a.o. the Sava river basin.

In the Action Programma of the ICPDR, the use of natural retention areas (flood plain areas) for *long-term flood protection and retention strategy, based on the enhancement of natural retention* is a highly preferred measure. Also, the ICPDR promotes to manage these natural retention areas in an environmentally sound way. This framework will have its effect on the filling in of the flood action plan for the Sava river. This is scheduled to be delivered at the end of 2009 by the Sava River Basin Commision.

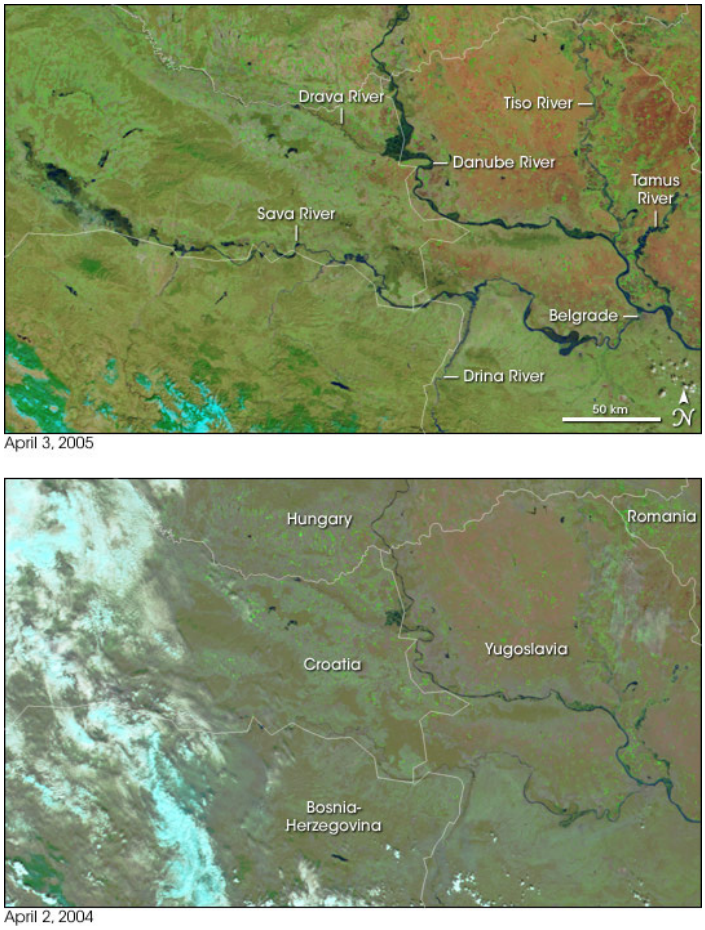


Figure 13 Above image is of the spring flood in the Sava river on the 2nd of April 2005, second image of the day after, when floods have retreated; http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16872).

Along the Sava are, relatively in the Danube river basin, still a large surface of natural flooded areas present (DPRP, 1999; see also Figure 13). However, most of the original natural flooded areas along the Sava are embanked and cut of the river bed. These embanked areas could be converted again in flood retention areas.

A sound defense system to safeguard build up areas from flooding of retention areas needs a certain surface and coherence. Also a sound ecologically functioning of the Sava river requires a certain surface of natural area and coherence. The retention area of Lonsko Polje has shown that the function of retention and of nature and biodiversity can coincide par excellence. The process of floods in the periods of natural high discharges favors both the original river related biodiversity and the attenuation of the flood wave in the river bed. The required coherence of measures for flood prevention offer excellent opportunities to create conditions for a robust biodiversity in and along the Sava river.

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Appendix 1 Spatial data categories according to INSPIRE

Spatial data component (data categorie)	Environmental issue													
	Water – inland, sea	Air and climate change	Nature/Biodiversity	Soil	Land	Waste	Noise	Heath	Hazerd/risks	Trans[port and environment	Agriculture/forestry	Energy	Coast (and sea)	Urban/local planning, EIA
Geographic location														
Geodetic reference system														
Geographical grids														
Monitoring sites														
Geographical names														
Administrative units														
Official administrative units														
Blocks and census districts														
General governmental management units														
Sector management units														
Properties, building an addresses														
Properties														
Buildings														
Adresses														
Elevation														
Elevation														
Bathymetry														
Coastline														
Geo-physical environment														
Bedrock geology														
Geo-morfology														
Soil														
Climate														
Climate zones														
Hydrography														
Water catchments														
Groundwater														

bodies/aquifers														
Ocean and seas														
Sea regions														
Biota/biodiversity														
Biomes/Bio-ecological regions														
Vegetation														
Habitats and biotopes														
Species distribution														
Land surface														
Land cover														
Ortho images														
Unclassified satellite images														
Natural resource														
Water resources														
Agriculture and soil resources														
Forest resources														
Fishery resources														
Geological resources														
Renewable energy resources														
Transport														
Transport networks														
Transport facilities														
Utilities														
Tranmission lines														
Facilities														
Environment protetion facilities														
Production facilities														
Agricultural facilities														
Economy														
Economic statistics/local statistics														
Area Regulation														
Land regulation/land use planning														
Protected sites														
Sector regulation														
Natural and technological risks														
Natural risk vulnerability zones														
Technological risk vulnerability zones														
Technological accidents/natural disaster														

Society														
Demography														
Settlement														
Green urban area														
Derelicted urba areas														
Cultural heritage														
Natural amenities														
Health														
Epidemiology														
Health services														

Appendix 2 Report workshop 1 "Data inventory"

"Available data on the Sava river basin and requirements for the analyses of ecological networks along the Sava"

In the framework of the project "Integrated River Basin Management"

Date: **4 – 5 April 2005**
Venue: **Ministry of Culture, Zagreb, Croatia**

Objectives workshop:

- Getting an overview of available spatial ecological data in the Sava river basin
- Selection of available data that is suitable for the analyses and development of a tentative ecological network along the Sava River and its tributaries.
- Preparing an outline for the development of a GIS for the Sava river basin
- Exchanging experiences on the use of GIS and databases for Natura 2000 purposes.

In green: actions that are agreed in the workshop

Monday 4th of April

- **Opening of workshop by Mr. Draganovic**

- **Introduction of participants**
  See annex 1: participants list

- **Inventory of participants on surplus value on transboundary river basin management**

Croatia

Mr. Eugen Draganović:	Croatia is very much interested in transboundary river basin management. Upstream in Slovenia the tributaries are of importance as well downstream the possible construction of dams. Measures taken in other Sava river basin countries do have consequences for Croatia and vice versa. Croatia is waiting for the Sava Commission to be installed. Water management and nature conservation are not two separate aspects, but should be taken into account as one.
Ms. Jasminka Radović:	We all share the consequences so we should cooperate.
Ms. Ramona Topić:	I agree with Mr. Eugen Draganovic and Ms. Jasminka Radovic.
Mr. Goran Gugić:	Lonjsko Polje is the largest park in former Yugoslavia and functions as a retention area in the Sava River Basin. This is not only important for Croatia, but also for the other Sava river basin countries. Mr. Gugić is very much interested in transboundary cooperation. Other retention (detention) areas should be identified. A network and exchange of information is important to make wise decisions.

Slovenia

Mr. Damjan Vrček: In Slovenia the national ecological network has already been established and nature conservation areas are identified/indicated. I'm not sure what knowledge and information of the Sava river basin would be of interest to exchange amongst the different Sava river basin countries.

Mrs. Andreja Skvarc: I agree with Mr. Damjan Vrcek.

Serbia & Montenegro

Mr. Rastko Ajtić: The Sava river is important for drinking water. The landscape along the Sava river is important in terms of nature conservation.

Mr. Predrag Lazarević: The importance of nature conservation is clear.

Bosnia - Herzegovina

Mrs. Sabina Trakić: Most has been said already. Transboundary river basin management is a necessity not a benefit. Both water management and nature conservation are of importance.

- **Introduction to the program and objectives (Sabine van Rooij)**
  Presentation is sent as attachment

- **Presentation on GIS (Anne Schmidt)**
  Presentation is sent as attachment

- **Discussion GIS: what criteria should apply for a GIS on the Sava river basin?**

  Conclusions:
  - Every party is convinced that there should be a common, shared GIS c.q. spatial data infrastructure on the Sava river basin
  - All parties present think that central coordinator of such a GIS c.q. spatial data infrastructure should be Croatia (until it can be transferred to a GIS-specialist of the Sava river basin commission), as the largest part of the Sava floodplains are on Croatian territory and a spatial data-infrastructure is present. The ministry of Culture of Croatia is willing to do this.
  - Every country holds its own datasets, but makes it available to the central coordinator (Croatia).
  - All spatial data collected should be available to all participants of the SAVA project, this can be done in different way (e.g. through webservices)

  Agreed products at the end of the project:
  - A worked out proposal on a GIS on the Sava river basin, for further discussion towards a GIS for the Sava river basin commission (action Ms. Anne Schmidt from The Netherlands in cooperation with Mr. Neven Trenc from Croatia)
  - Agreements on common use of datasets should be discussed and reached
  - A start with the implementation of a common GIS c.q. spatial data infrastructure, with the spatial data (digital maps) available for Sava river basin
  - Inventory of required computer server and other hardware / software and possibly acquiring of it (depending on budget)

- **Presentation of available spatial ecological data, Serbia-Montenegro (Mr. Rastko Ajtić)**
  Presentation is sent as attachment

Availability of data:

- The following data are available of Sava river basin:
- Lists and global maps of wetland areas
- Maps of forest areas
- However, basic electronic data (in digital form) base of ecological data is lacking
- Data on species: only available on paper
- Also available maps: only available on paper (analoque form)
- Maps on land use: unclear if these are available. Mr. Rastko Ajtić will check this (action Mr. Rastko Ajtić)

Biodiversity:

- Highest biodiversity: in Montenegro (southern part of the Drina) and also along Tara river: hotspots of biodiversity: both in Karst area (between 200 – 2500 m)
- Threats for biodiversity: building of electric power dams

Conclusions

- Lack of basic elecronic data (data in digital form)
- Lack of long term monitoring studies
- Foundation of electronic data is in progress

- **Presentation of available spatial ecological data, Bosnia-Herzegovina (Sabina Trakic and Tihomir Predic)**
  Presentation is sent as attachment

  In general: the data that are presented are assessed in the framework of this project; not all available literature is assessed yet.

  Data on species and habitat types
  Of the species and habitat types of Natura2000 (the annexes of Bird directive and Habitat directive) the most important sites in Bosnia are being identified and the species and habitat types (plant communicties) are described (ecological characteristics). This information is being collected in a database (digital form).

  Mr. Tihomir Predić: we do not have your presentation yet; could you send this to us by e-mail?

  In a GIS (spatial data in digital form) are available:
  - DTM
  - Pedology data (soil type, 1:50.000)
  - Land cover & land use data (1:200.000)
  - Climatic data
  - Protected areas (mapped for the PEEN-project)
  - Nature reserves
  - Spatial distribution of some species (Bear, Mountain goat;)

  Available data on spatial distribution of species:
  - Data on spatial distribution of birds and mammals are present more or less
  - Not included in the metadata survey yet: Amphibians (sites are mapped) Butterflies.

- **Presentation of available spatial ecological data, Croatia (Kristijan Civic)**
  Presentation is sent as attachment

General remark
The study area should be defined as the whole catchment area of the Sava river is to big to be considered in the present project.

Habitats classification
The habitats classification used in CRO-NEN: A translation of this classification into EUNIS classification (zie http://eunis.eea.eu.int/habitats.jsp and http://glossary.eea.eu.int/EEAGlossary/E/EUNIS_habitats_classification) and to Paleartic classification is possible (throught translation keys)..
The CORINE landcover is finished; is soon avaible

- **Presentation of the development of the Nature Protection Information System,** of data **Croatia (Mr. Neven Trenc)**
  Presentation is sent as attachment

  Availability of data
  Availability that were gathered in this system as hydrography and DTM were bought, and can not be transferred to a GIS for the Sava.
  Data on habitats, an inventory of wetlands and the results of CRO-NEN (end of May 2005) however are available.

- **Presentation of available spatial ecological data, Slovenia (Damjan Vrcek)**
  Presentation is sent as attachment.

  Availability of data
  As in Croatia, also in Slovenia the problem is not the presence of data, but the availability of data (restrictions). Many data are not owned by the Ministry of Nature (e.g. hydrological data; basic ecological data). These data have to be bought from private companies or agreements with other Ministries have to be made.

- **Presentation on ecological networks (Theo van der Sluis)**
  Presentation is sent as attachment

  It is emphasised that an ecological network, as aimed for in this project, can be functional (i.e. based on the functions of the natural areas for the ecosystems and species), in contrast to a network based on protection status. The functional ecological network is defined for wetland ecosystems and specific species groups. As a result, it is not a new plan for once more areas to be protected, but should be seen as a basis for areas that deserve protection, and it may be used to improve a (formal, existing) ecological network.

Conclusions:
Data on amphibian\reptiles and birds seem to be best available on the Sava river

Tuesday 5th of April

- **Discussion on approach network development Croatia / Slovenia**

Ecological network in Slovenia (Damjan Vrcek):
The national ecological network (NEN) has been established at same time that the Natura2000 sites have been assigned.

Criteria for the national ecological network (NEN):
- All Natura2000 sites included (Bird Directive and Habitat Directive)
- Red List species

- Endemic species
- Endangered species
- Migratory species

Legal status
Concerning the Ecological Network there are guidelines for spatial planning.

Approach
A team of experts have chosen per species the core areas and corridors per species. So it is based on best expert opinion, not on modelling. The northern border of Slovenia is a mountaneous area. In the North West is a National Park. Cross border relations are easier with West European Countries because of available data and information (e.g. the link between ecological networks of different countries).

Next time they can bring the map of the national ecological network and discuss it.

Ecological network in Croatia (Mrs. Jasminka Radović):

Presentation experiences with NATURA 2000 and GIS in Croatia
Presentation is sent as attachment

A draft ecological network (CRO-NEN) was prepared in 2002. The national ecological network (NEN) is established at same time that the Natura2000 sites have been assigned.

Criteria for the national ecological network:
- Natura2000 (Bird Directive and Habitat Directive)
- National Red List species

Presention on the Sava area (Mrs. Ramona Topic)
Presentation is sent as attachment

In the Sava River Basin wetland areas (complexes) have been indicated.

New software is being developed to store data/information for the National Ecological Network with possibility to export data/information for amongst others Natura2000 and Emerald. There is also a database on Biodiversity.

Indicative CRO-NEN (PEEN) scale 1:500.000. Website: www.cro-nen.hr

Legal status
Nature protection law includes the national ecological network. The NEN should be incorporated in spatial planning.

- **Agreement on approach for Ecological Network assessment SAVA River**

The following definitions and limitiation have been adopted for this project:

The concept of an Ecological Network*:*
There are different interpretations of the concept of an ecological network. It can be considered as an instrument for policy makers and than it has a formal/legal status. It can be interpreted as well as a functional network from an ecological perspective. In this project we define an ecological network in the latter, functional way.

Definition of the study area
To limit the area (the Sava River Basin is huge!) a functional restriction is made on request of participants, to those wetlands which are under the direct regime of the SAVA

river. Carstic features and upland wetlands are therefore largely excluded. The focus is therefore on: "*The floodplain area along the Sava river (focused on selection of habitats/habitat types) including areas in the river basin that are functionally connected with areas in the Sava floodplain*".
Restrictions for Slovenia: only the areas (sites) that are part of the present national ecological network will be considered (due to political reasons).

Selection of ecosystems / habitat types of interest for this project:
In this phase of the workshop it is discussed which habitat types we should focus on for the development of an ecological network, as well as which species groups we may choose for network design.

River related habitat types present in the Sava river basin are listed by the participants:

- Alluvial forests (hard wood forest)
- Wet grasslands
- Carp fish pond
- Gravel pits
- Reed lands
- Shallow sandbanks
- Oxbows
- Marshland/bogs
- Alluvial or gallery forest (softwood forest)
- Gravel banks

A clear definition of distinguished habitats/ecosystems is of importance; herefor it is decided to use the Paleartic classification) Jasminka will make a proposal for a correct conversion of the selected habitat types to the Paleartic classification.

Selected habitat types by participants:
We can not analyse all the different habitat types which are present (selection above), nor is information available for all these types in all countries. Therefore a selection of 3 different habitat types is made, which seem representative, and diverse in species/communities.

1. Alluvial forest; hardwood forest
2. Wet grasslands
3. Oxbow lakes
4. Alluvial forest; softwood forest (to combined with 1)

Data availability of selected ecosystems:
Per country is indicated wehter good maps exist, either in digital or paper format:
Ad 1 Alluvial Forest; hardwood forest
Slovenia: detailed forest map
Croatia: to be derived from habitat map
Bosnia: to be derived from land use map
Serbia: to be derived from different sources

A2 Wet grasslands
Slovenia: to be derived from land use map (not according to Paleartic classification)
Croatia: to be derived from habitat map
Bosnia: to be derived from land use map (not according to Paleartic classification)
Serbia: to be derived from different sources

Ad 3 Oxbow
Slovenia: mapped water bodies
Croatia: map of water from other company + added attributes
Bosnia: can be distracted from satellite images
Serbia: available on maps, some of them protected areas

Ad 4 Alluvial forest; softwood forest
Slovenia: not clear
Croatia: to be derived from habitat map
Bosnia: to be derived from land use map
Serbia: map of Ministry of Forestry

Selection of further available spatial data of interest for this project:

Land use/land cover maps
Slovenia: CORINE
Croatia: CORINE (if available) + habitat map
Bosnia: land use/land cover map
Serbia: use for the time being CLC and/or PELCOM

Satellite images
Landsat TM images (free available/downloadable:
http://glcf.umiacs.umd.edu/index.shtml)
Transfer projection into Gauss Kruger projection system
Action Ms. Anne Schmidt

Flooded area:
Slovenia: is available
Croatia: in digital form to be derived from Croation Waters
Bosnia: to be derived land use/land cover map: class peridodically flooded
Serbia: no data

Topographic map
Slovenia: available, not sure for the project, not scale 1:100.00 but scale 1:150.0000
Croatia: Should be bought; 500 kuna (65 euro) per sheet, 15 sheets needed for Croatia
Bosnia: should be bought, availabel at State Institute, should be checked!
Serbia: in analoque form, differenct scales, also scale 1:100.000

Protected areas
Slovenia: available
Croatia: available
Bosnia: available in dots
Serbia: available in analogue form

Availability of data:
Data can't be made available as such. The data can be used in the workshop in May. The map of the ecological network of the Sava river basin retrieved from these data can be distributed later.

Selection of species (groups) of interest for this project:

Species groups:
1. Plants
2. Birds
3. Mammals

4. Amphibians/Reptiles
5. Invertebrates
6. Fishes

Ad 1 Plants

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: database is available, not for free, also some data at institute, red book
Bosnia: only specific categories, not digital
Serbia: is available, not digital

Ad 2 Birds

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: partly in GIS (88 species), currently ornithologists are providing maps for the Bird Directive
Bosnia: is available
Serbia: is available

Ad 3 Mammals

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: distribution maps in GIS
Bosnia: doesn't cover all Sava river basin
Serbia: database available, not sure whether it is for free

Ad 4 Amphibians

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: is available
Bosnia: is available
Serbia: is available, working on distribution maps

Ad 5 Invertebrates

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: butterflies (red book) and dragon flies (not sure)
Bosnia: aquatic invertebrates have been investigated + crustacean
Serbia: different groups, data in four different institutes, not clear, no electronic database

Ad 6 Fishes

Slovenia: of the sites that are designated, not on the spatial distribution of species, database is available for the project, atlases are available
Croatia: in paper from for red list species, now digitizing
Bosnia: well covered, investigation done (not in small water surfaces)
Serbia: covered in paper form (species and subspecies), checklist, only important species distribution maps

Agreed is that:

- Jasminka will send the latest version of the Palearctic classification to Alterra, (action Jasminka).
- Alterra will make a proposal for the classification of habitats to the selected habitats for the ecological network (action Theo/Sabine).
- Alterra will make a selection of species that can be used for the ecological network assessment, based on the species meta data of Bosnia and Serbia. After that, we will send the selection to Slovenia and Croatia, and request data from these countries.

Agreements on exchange of data

- All data of Croatia (CORINE?, national ecological network, habitat map, protected areas, spatial distribution maps of species as far as available) that is used in PEEN is to be derived through Irene Bouwma (Alterra) as it takes to long time to follow the official way.;
- Bosnia can send the land use map; 4 weeks
- Slovenia can send all data (CORINE, national ecological network, protected areas, spatial distribution maps of species as far as available) that they have: 2 -3 weeks.

For the time being Anne Schmidt will be the central contactperson for the GIS. She will contact the partcipants about the collection of (spatial) data (action Ms. Anne Schmidt).

Issues on GIS:

How to hand over the project in the end?
Anne Schmidt (Alterra) will make a proposal together with Neven Trenc (Nature Impact Assessment Department), this will be communicated with H. Zingstra (action Ms. Anne Schmidt and Mr. Neven Trenc)

- **preparations for the next workshop in May (development of ecological networks and recommendations for improvement**

The proposed date for the second workshop in week of 30th may to the 3th of june, Suggestion of venue: Sarajevo. This is OK for croatia and slovenia.

Potential problem: digitizing data by Serbia.

- **Exchange of experiences with Natura 2000 and GIS.**

  Presentation Natura 2000 in Slovenia (Damjan Vrcek)
  Presentation is sent as attachment

  Presentation NAtura 2000 and GIS, the Netherlands (Anne Schmidt)
  Presentation is sent as attachment

Questions on the different approaches and experiences are exchanged. In particular, the role of NGO's is of interest of participants.

- **Closure and evaluation of workshop**

The following issues have been evaluated: the project (useful?), the workshop (surplus value?) and the agreements (feasible?).

Croatia: Workshop is useful. Most useful of the workshop; exchange of experiences and state of affaires with GIS. Agreements are feasible. Interesting to hear what is happening in other Sava river basin countries. The difference between the data availability between Slovenia and Croatia on the one hand and Serbia – Montenegro and Bosnia – Herzegovina on the other is very big. For the later countries; project is a good opportunities to catch up a little. However, very little time is available in project to do the required work. Good opportunity for Croatia to support the other countries.

Slovenia: Doubts about the project; surplus value for the institute not clear. Exchange of experiences and knowledge was interesting. Agreements for Slovenia are feasible.

Serbia - Montenegro: Had to leave early; so no evaluation (Rastko and Predag; could you add your opinion on the project, workshop and agreements?)

Bosnia - Herzegovina: Workshop was more than useful; for Bosnia there is much to learn of the experiences and state of affairs in Croatia and Slovenia. To catch up is very difficult and ambitious. Project is opportunity to make a start.

Participants workshop SAVA River Project

Name	Organisation
Mr. Rastko Ajtić	Institute for Nature Conservation of Serbia
1. Mr. Kristijan Civić	MEPP, ecological network project CRO-NEN
2. Mr. Eugen Draganović	Head Protected Areas, Min. of Culture
3. Mr. Goran Gugić	Managing director of Lonjsko Polje Nature Park
4. Mr. Predrag Lazarević	Institute for Nature Conservation of Serbia
5. Ms. Maja Palković	Ministry of Culture, Dep. for Nature Protection
6. Mr. Tihomir Predić	Agricultural Institute, Banja Luka
7. Ms. Jasminka Radović	State Institute for Nature Protection
8. Ms. Sabine van Rooij	ALTERRA, Landscape Centre
9. Ms. Anne Schmidt	ALTERRA, Centre for Geo-Information
10. Ms. Andreja Škvarč	Institute of the Republic of Slovenia for Nature Conservation Slovenia
11. Mr. Theo van der Sluis	ALTERRA, Landscape Centre
12. Mr. Daniel Springer	Ministry of Culture, Dep. for Nature Protection
13. Ms. Ramona Topić	State Institute for Nature Protection
14. Ms. Sabina Trakić	Centre for Ecology and Natural Resources CEPRES Bosnia & H.
15. Mr. Neven Trenc	State Institute for Nature Protection (Information System) Croatia
16. Mr. Damjan Vrček	Institute of the Republic of Slovenia for Nature Conservation Slovenia

Absent, apologies

Mr. Joerg Lohmann	IUCN
Mr. Martin Schneider-Jacoby	Euronatur
Mr. Henk Zingstra	IAC
Ms. Senka Barudanovic	Centre for Ecology and Natural Resources CEPRES Bosnia & H.

Appendix 3 Description of selected habitat types (EUNIS-classification)

Selected habitat types in workshop 1 were:

1. Alluvial forest; hardwood forest
2. Wet grasslands
3. Oxbow lakes
4. Alluvial forest; softwood forest (to combined with 1)

The following Palaearctic classes are proposed to be corresponding with these habitat types:

Alluvial forest; hardwood forest
44.3 Middle European stream ash-alder woods
44.4 Mixed oak-elm-ash forests of great rivers

Wet grasslands
37.2 Eutrophic humid grasslands
(37.3 Oligotrophic humid grasslands?)
37.6 Sub-Mediterranenan humid meadows

Oxbow lakes
22.1 Permanent freshwater ponds and lakes
(22.2 Temporary freshwater bodies?)
(22.4 Lacustrine euhydrophyte communities?)
53.1 Reed beds
53.2 Large sedge communities
53.4 Small reed beds of fast flowing waters (important for landscape connectivity)

Alluvial forest; softwood forest (to combined with 1)
44.1 Riparian willow formation
44.9 Alder, willow, oak, aspen swamp forest

Appendix 4 Inventory of data in Croatia and Slovenia

SLOVENIA Theme/subject	Description	Scale	Projection system	Extent / coverage	Source / copyright	Availability dataset	Remarks
Geographical location (topography)							
Topography	Topographic maps (digital/scanned?)	1:25.000	Gauss Kruger	Slovenia			There are topographic maps of Slovenia, Croatia, Bosnia and Servia. Formerly they were available at the Army Institute in Belgrado.
Earth observation/remote sensing images							
Landsat TM	Used for CORINE database	1:100.000	Gauss Kruger	Slovenia			
Ikonos	Satellite data with high spatial resolution	1:10.000		only parts of Slovenia			
Digital (?) aerial photographs	True colour or false colour? Used for habitat mapping.	?	Gauss Kruger	Slovenia			
Protected areas							
Natura2000 areas	Areas assigned within the framework of the European Bird directive and the Habitat directive. Natura2000 database (accesdatabase) is a seperate database and not yet connected to the GIS. In the natura200database a description is given of species from the Red List, National Protected species, Bonn Convention Bern Convention and Barcelona Convention. Within a LIFE project a database for monitoring is being developped.	?	Gauss Kruger	Slovenia			
Ecological important areas	Areas protected by national law (N2000 + extra sites). According to Ecological Network principles (including corridors). There is a database on the Ecological Network with field data/observations. People from regional offices make observations	?	Gauss Kruger	Slovenia			
National, regional landscape parks	Areas protected by national law.	?	Gauss Kruger	Slovenia			The spring of the river Sava is assigned as national park.
Nature heritage sites	Different type of nature heritage sites: points: amongs others trees, caves, pond and pieces of forest; polygons: interesting areas rrom a geomorphological point of view	?	Gauss Kruger	Slovenia			

Biodiversity						
Habitats	Habitat map according to Paleartic classification system (see http://glossary.eea.eu.int/EEAGlossary/E/EUNIS_habitats_classification); A distinction is made between forrested and non forested areas; Forrested areas are not mapped in detail; Forresters have their own mapping systems; Habitat types cover to small areas in the forest to be mapped seperately and are therefore distinguished in complexes (mapping units); Per habitattype there is a ecological description and translation to other classification systems; A list of typical plant species is given per habitattype (quality aspect of habitattype); The conservation status of the habitattypes is based on expert knowledge; The map seems to be to detailed and to elaborate; It should be more focussed on nature management; Models (formats/requirements) are prepared for nature management plans; The same typology is used in these management plans.	1:5.000	Gauss Kruger	5 % of Slovenia is mapped	Institute of the Republic of Slovenia for Nature Conservation	
Natura 2000 background coverages	distribution maps for a selection of N2000-species and habitat maps of species groups that are relevant for selection of natura 2000 sites. X-Y coordinates of species Bern convention	?	Gauss Kruger	Slovenia		
Species	Scientific database on flora and fauna species + plant communities based on different information sources (fieldwork, literature); X and Y coordinates are available or geographic location is indicated based on aerial photograps.	?	Gauss Kruger	Slovenia	Center for Cartograhpy of Fauna and Flora (Mladen Kotarac)	
Forest vegetation type	map is available	?	Gauss Kruger	Slovenia		
Hydrography						
Rivers, catchment areas etc.	At the Ministry on Environment and Physical Planning there should be data available on hydrography amongs others kadastral maps of rivers. Rivers are divided in sections, a classification system for the purpose of fishery.	?	Gauss Kruger	Slovenia	Ministry on Environment and Spatial Planning	check website EUROWATERNET (http://www.gu.gov.si/Gu_eng/Present/Present.asp)
Rivers	data derived from Water institute					
Geomorfology						
Geomorphological map		?	Gauss Kruger	Slovenia		
Land use						
CORINE land cover database		1:100.000	Gauss Kruger	Slovenia		
Digital terrain model						
Elevation map	Derived from topographic map.	?	Gauss Kruger	Slovenia		

General remarks:	*Data are available in ArcView 3.2 (ArcMap). Of some of the data metadata is available in the form of textfiles not in a metadatabase. They have Arc catalog to their disposition, but do not use it at the moment.*	
Tips for webpages:	http://www.gu.gov.si/gu_eng/present/present.asp Surveying and Mapping Authority of the Republic of Slovenia (SMA), part of the Ministry of the Environment and Spatial Planning	overview of available topografic digital maps and aerial photographs in Slovenia
	http://nfp-si.eionet.eu int/ewnsi/index.html	??

CROATIA Theme/subject	Description	Scale	Projection system	Extent / coverage	Source / copyright	Availability dataset	Remarks
Geographical location (topography)							
Topographic maps		1:25.000	Gauss Kruger	Croatia	State Geodetic Administration		There are topographic maps of Slovenia, Croatia, Bosnia and Servia. Formerly they were available at the Army Institute in Belgrado. Now available at the Geodetical Administration…against costs. The Ministry of Environment get a special price.
Earth observation/remote sensing							
Landsat TM	Used for CLC and habitat map database	1:100.000	Gauss Kruger	Croatia	maps have been bought only for the purpose of the project (year 2000)		
Protected areas							
Natura2000 areas							
Ecological Network (CRONEN)	A GIS with the Ecological Network of Croatia is being prepared in the framework of LIFE and should be finished in june 2005. It is based on diferent thematic layers. A concept version is available. Indicated are preliminary areas of international importance trough Croatian part of the PEEN.	1:100.000	Gauss Kruger	Croatia	SINP	SINP	

Biodiversity							
Habitats	The habitat map is compatible to CORINE database and based on satellite images according to the Paleartic classification (see http://glossary.eea.eu.int/EEAGlossary/E/EUNIS_habitats_classification), field work and aerial photographs. Habitats are mapped according to Croatian national habitat classification, and keys are available for translation to PHYSIS and EUNIS classification.	1:100.000	Gauss Kruger	Croatia	Ministry of Culture, SINP	Ministry of Culture, SINP	Permission should be asked at the Ministry of Culture
Species	There are data available on species. For the observation on some (red list) plants species X and Y coordinates are available. Red books are being publsihed on different species groups.	1:100.000	Gauss Kruger	Croatia	SINP	SINP	
red list species	distribution maps (polygons; only for plant species points); see also books on red lists	1:100.000	Gauss Kruger	Croatia	SINP		
important plant areas	under construction; ready in spring 2005	?	Gauss Kruger	Croatia	Faculty of Natural Science, Department of Botany/ REC		
Hydrography							
Rivers, catchment areas etc.	These data are important in order to define the Sava River Basin	1:100.000	Gauss Kruger	Croatia	GISDATA Ltd.	SINP	SINP has bought a licence from GISDATA Ltd
Catchment areas	According to definitions of 'Hrvatske vode' ('Croatian Waters')		Gauss Kruger	Croatia	HRVATSKE VODE Ltd	SINP	SINP has got a licence from HRVATSKE VODE for the project *Wetland Inventory*
Geology							
	Distribution of geological layers is mapped - only printed maps exist, there is no GIS database	1:100.000	Gauss Kruger		Croatian Institute of Geology	Croatian Institute of Geology	Maps can be bought in the Institute
Pedology							
	Distribution of all types of soil is mapped	1:300.000	Gauss Kruger	Croatia	Faculty of Agronomy	SINP	SINP has bought a licence from Faculty of Agronomy
CORINE land cover database	Prepared trough LIFE III CLC project, finished in March 2005	1:100.000	Gauss Kruger	Croatia	Ministry of Environmental Protection, Physical Planning and Construction and Croatian Environmental Agency	Croatian Environmental Agency	
Digital Terrein Model							
DTM		1:100 000	Gauss Kruger	Croatia	GISDATA Ltd.	SINP	SINP has bought a licence from GISDATA Ltd
General remarks:	*Permission to use these data for the Sava-project shpuld be asked at the Ministry of Culture. ECNC has made a agreement on the use of these datasets in the framework of the Pan European Ecologcial Network.*	1:25 000; 1:5 000	Gauss Kruger	Croatia	State Geodetic Administration		DEM can be bought from State Geodetic Administration, DEMs (in these scales) are available for some parts of the country, not for the complete teritory

Protected areas Croatia

Inventory of the Protected Areas in the Danube River Basin in Croatia

No.	Name of the Protected Area	Total Surface (ha)	Geographical Location	Local River basin	IUCN Classification	Protected by the Low of the Nature Protection
1.	**Plitvička jezera** National park Incl. Special reserve primaveral forest	29 642	Karlovac and Ličko-senjska county	Korana river	II	1949
2.	Risnjak National park	6 400	Primorsko-goranska county	Kupa river	II	1953
3.	**Kopački rit** Nature park Incl. Special reserve (zoological)	17 800	Osječko-baranjaska county	Danube river	VI, V Ramsar site	1967
4.	**Lonjsko polje** Nature park Incl. 3 Special reserves (ornithological)	50 600	Sisačko-moslavačka and Brodsko-posavska county	Sava river	VI Ramsar site	1990
5.	**Papuk** Nature park	33 600	Požesko-slavonska and Virovitičko-podravska county	Drava river and Sava river	VI	1999
6.	**Crna Mlaka** Fish ponds	650	Zagrebačka county, near Jastrebarsko town	Kupa river	I Ramsar site	1980
7.	**Vražji prolaz and Zeleni vir** Geomorphological natural monuments	200	Primorsko-goranska county, near Skrad town	Kupa river	III	1962
8.	**Prašnik** Special reserve (forest)	52	Brodsko-posavska county	Sava river	III	1965
9.	**Lože** Special reserve (forest)	110	Vukovarsko-srijemska county	Sava river	III	1975
10.	**Jankovac** Forest park	640	Virovitičko-podravska county	Drava river	VI	1955
11.	**Slušnica** Water course	200	Karlovačka county Near Slunj town	Kupa river	III	1964
12.	**Jelas polje** Flood plain	20 800	Brodsko-posavska county	Sava river	VI	1995

See next page.

Areas are selected by : mr.sc. Eugen Draganovic - Head of department for protected areas in Direction for Nature Protection of Ministry of Environment and Spatial Planning - Official Representative of Ministry of Environment and Spatial Planning for the cooperation with ECO EG in an Inventory of Protected Areas in the Danube River Basin.

Contact : tel. +385 1 610 6170, eugen.draganovic@duzo.tel.hr

Areas are selected from parts of nature protected by Nature Protection Law as most valuable and important areas from the point of view of their natural values, regime of protection and international verification.

Appendix 5 Report workshop 2 "Ecological networks"

"Ecological Network development for the Sava river basin"

Date: 30 – 31st June 2005
Venue: Sarajevo, Bosnia-Hercegovina
Presided by: Alterra (Sabine van Rooij, Theo van der Sluis)
Framework: Project "Integrated River Basin management of the Sava River", managed by the International Agricultural Center (Mr. Henk Zinkstra)

Objectives workshop:

- Recapture of progress / decisions workshop April
- Overview of (here) *available data* on selected riverine habitats
- *Selection of suitable species* for the development of an ecological network of these habitats
- Putting *distribution data* on the map: *Identification of important habitat areas* (how does the ecological network now look like?)
- *Analysis of the spatial cohesion* of the ecological network and proposals for improvement
- *GIS*: feasibility of gathering data in GIS; how to deal with user restrictions?

Monday 30th of May

- ***Welcome by Ms. Azra Korac-Mehmedovic***

- ***Introductory words by Prof. S. Redzic***

Prof. Redzic explains about the heterogeneous character of the Sava river basin and it associated fauna as a result of differences in geomorphology and geology.

- ***Introduction of participants***

- ***Introduction to the program and objectives (Alterra, Sabine van Rooij)***

Presentation will be sent.

- ***Approach ecological networks (Alterra, Theo van der Sluis)***

Presentation will be sent.

- ***Discussion and questions***

Bosnia-Hercegovina:

- In the Sava river basin, basic field data are lacking. We need to collect these first: the coherence of populations and habitat is a step too far!
- We are countries in transition. This brings about many threats for natural areas nowadays, e.g. deforestation (both legal and illegal), and changes in land use (lack of spatial planning, protection of natural areas)
- The Ministry has no framework for nature conservation: there is no monitoring of nature, no collection of data, there are no official red lists and so on. Also, nature management takes place at many different levels, and therefore it is very scattered and complicated.
- Making a link with the Habitats and Birds directive will enlarge the importance and impact of this project on the political agenda.

Serbia-Montenegro:

- Also here is the problem that there is little support from the Ministry

- We should focus on a specific area in the Sava-river basin.

All countries:

- There is too little data and knowledge now present here to do a realistic network evaluation.

- ***Proposed methodology in this workshop (Alterra)***

Adjustments:

- An inventory is made of threats for nature conservation in the Sava river basin.
- Extra attention is paid to the species of the Habitat and Birds directive.
- This workshop will be an exercise of the ecological network approach and assessment.

- ***Minutes last workshop – evaluation of actions and progress***

Concluded was that there is little progress on the agreed activities of last workshop, especially in sending data / maps. This has effect on the work that can be done and the results of this workshop: we now have no spatial data to work with.
The lack of progress, in particular the availability of spatial data affects also the completeness of the common GIS on Sava that was foreseen in this project.
It also affects the information that can be used in the following PIN-MATRA project.

- ***Presentation of available maps***

As no spatial data where received from the institutes, Alterra has downloaded the LANDSAT-TM images, converted projections to the common system and printed them, to have some land cover information in the Sava river catchment. Also a hydrography map of the Sava river basin and the Pelcom land use map was printed for this workshop. This LANDSAT image will be made available for all partners. Anne Schmidt and Neven Trenc will provide this information to the partners. (action A. Schmidt and N. Trenc)
Short discussion on the GIS-work to be done; this issue will be addressed more extensively tomorrow.

- ***Identification of oxbows, (fishing) ponds and wetland areas***

Based on the available maps, books and expert knowledge, wetland areas were mapped by the participants on transparent film on the map (scale 1:400.000). The result is a very coarse map: large complexes of woodland, wet grassland and wetland were indicated as “wetland area”.

- ***Overview of wetland species and species selection***

As a preparation on this workshop, Alterra has pre-selected species that can be suitable for the assessment of ecological networks along the Sava.
The pre-selection of species from Alterra is used as a basis. The list is based on:

- available knowledge of species
- indicator value for river ecosystems
- distribution and range of species

For each country is indicated by the participants if a species of the pre-selection on this list may be useful for network assessment (not too common, not too rare) and if the species is protected nationally or included in the Habitat or Bird’s directive. In addition some species were added by participants, which are considered very characteristic for the Sava, the Black and White stork.
Based on these results, 4 wetland species were proposed for further network assessment in this workshop. These are:

Dispersal capacitiy (km)	Required area key population (ha)	eng. name	scientific name
3 -- 7	125	European tree frog	Hyla arborea
7-15	200	Bluethroat	Luscinia svecica
25 -- 35	740	Bittern	Botaurus stellaris
	13000	Otter	Lutra lutra
	10000	Black stork	Ciconia nigra

The complete list of pre-selected wetland species is included in annex 1.

- ***Put distribution data of selected species on the map and indicate the quality/importance of wet grassland areas***

Partipants have indicated as detailed as possible the presence of breeding pairs of the selected species in the wetland areas. The result is that the assumed presence or absence of the selected species was indicated in the large “wetland”complexes.

Tuesday 31th of May

- **Introduction**

The agenda is adjusted based on the findings and evaluation of results from Mondays work and discussions.
It is seems that it is not possible to indicate quality of areas, because the experts present do not know the areas along the Sava river in sufficient detail. So we assume that the areas indicated are optimal habitat.
Also based on this, it is stressed that the results here must be seen as draft results, since the proper maps, which were required to come to a real network, are still lacking. The workshop is therefore in particular relevant to show the steps which need to be taken in the development process, and are of particular importance as training or capacity building.

- **Selection of wet grassland species**

A pre-selection of suitable wet-grassland species was made by Alterra and presented here. This list was considered by the participants; per species is indicated in which countries it is occurring in the Sava, as well as its presence in the Habitat and Birds directive. Included was/were also the Green toad and Yellow-bellied toad ??? as indicative for the Sava River. Based on these results, 4 wetland species were proposed for further network assessment in this workshop. These are:

Disperal capacity (km)	Required area for key population (ha)	english name	scientific name
0-3	30	Green toad	Bufo viridis
3—7	10	Large copper	Lycaena dispar
7 –15	150	Yellow-bellied toad	Bombina variegata
15—25	400	Badger	Meles meles
> 35	1000	Barn owl	tito alba

The full list of pre-selected wet grassland species is included in annex 2.
A list of pre-selected woodland species is included in annex 3. Due to lack of time and a more complex landscape situation, the habitat type riverine forest was not further assessed.

- **Drawing map grassland areas & improving wetland maps**

Similar as on Monday a map is prepared of important grasslands at scale 1:250,000. As mentioned above, the map for wetlands prepared on Monday turned out to contain too little detail. Therefore also wetlands are added on the map 1:250,000.

- **Evaluation of threats**

An inventory is made of all major threats to the selected ecosystems in regard of ecological network and network development. A prioritisation is made also for the different countries.
The results are as follows:

Threats	Croatia	BiH	S-M	remarks
illegal deforestation	x	X	X	
legal deforestation/ non sustainable forest management	x	X	**X (2)**	
drainage for agricultural practices/ increase of agricultural area	x	**X (3)**	**X (3)**	
hydrotechnical developments (power plants, straightening, damming)	**X (2)**	X	x	Also in Slovenia a (transboundary?) threat for nature
pollution / eutrophication (waste water, agriculture, industry)	**X (1)**	**X (1)**	**X (1)**	
land abandonment	X	x	x	
urbanization	X	X	X	
lack of ecological data	**X (3)**	**X (2)**	X	

X = important threat
X = less important threat
(1/2/3) = number 1/2/3 threat for riverine habitats

- **Evaluation of the maps**

Of the selected species for wet grassland (5) and wetlands (5), the spatial requirements, or the demands of a species in regard of their habitat area, were defined, and put in a table (see tables presented earlier). These areas are for key populations of a species: a

key population is a relatively stable population in a larger metapopulation (nb: these area requirements are based on scientific data for the Netherlands and / or other areas in Europe, so the areas that are required in the Sava-river could differ - however, the areas indicated give an impression what can be considered areas for strong populations in a metapopulation along the Sava!)

Based on the required area for key populations, it was assessed which habitat areas on the map may be regarded as key areas for a selected species. Started was with the species with the largest area requirement, and then worked down to the species with lower area requirements.

For wet grasslands, it appeared that some large habitat areas are present along the Sava and that these areas are well connected by a small strip of a.o. wet grassland along the river. A conclusion at this stage is therefore that this type of habitat is currently not (yet) fragmented and that the large clusters of habitat areas seem large enough to sustain viable populations of the selected species. However, the situation here is overestimated, as not all wet grassland habitat will be optimal, as is the underlying assumption. For grassland species no particular or very striking results are encountered: those areas that are identified as larger grassland areas seem indeed important. This conclusion should be taken with care, since we have no detailed land cover maps available to base these conclusions on.

Next, the wetland areas are evaluated for wetland species. Key areas for the selected species were selected. Striking is that most wetland areas seem large enough for key populations of the selected species, and the Sava River may form therefore a major corridor for the species.
However, a Red Data book for Croatia shows the limited presence of e.g. the Bittern in the area along the Sava River. The decline is attributed to the decline in reedland area, amongst others.
Based on this two major conclusions can be drawn:

- the importance of the ecological network (in particular the upstream areas with the fish ponds), as present areas where the Bittern occurs and the its role as source areas for re-colonisation of wetlands along the river
- The importance of field data with an indication of the quality of the areas for the assessment of the ecological network.

- **Agreement for maps use and exchange**

After the discussions on Monday a summary has been made in regards of use and exchange of maps.
It is a fact that at this moment the maps, if they would become available, can not be used anymore in the framework of this PfW. It is only in the succeeding (PIN-MATRA) project that the maps will be used, and be crucial once more. The implications and use of maps in the new project are not clear yet, and therefore the new agreement can not be prepared yet.
It should, however, receive the highest priority, immediately at the onset of the PIN-MATRA project!
Agreed in the framework of this project, is to propose and implement a suitable infrastructure as far as possible, for the exchange of data among the partners (action A. Schmidt and N. Trenc: at the Netherlands they should prepare a format or template for a data exchange agreement). The LANDSAT image will be the only data that can be put on this infrastructure. Data collection will not be part of this project, as an agreement will be required.

- **Closure workshop**

At 18.00 hrs. the workshop closes.
All participants are thanked for their active input and contribution. Arrangements are made for the meeting next morning, for the preliminary discussion of the PIN-MATRA project and the field excursion to Prokoško Lake at Vranica mountain.

Appendix 6 Selected species for wetlands

disp. Range	eng. Name	scientific name	Croatia	Bosnia-H.	Serbia-M.	HabBIrds
0 -- 3	Crested newt	Triturus cristatus	x	-		x
		Triturus carnifex mac.		(x)	-	x
	Danube newt	Triturus dobrogicus	x?	x	x	x
	Water shrew	Neomys fodiens	x	x	x	
	Adder	Vipera berus	x	x?	x	
	European tree frog	Hyla arborea	x	x	x	
3 -- 7	Root vole	Microtus oeconomus	?	-	-	x
7 -- 15	Savi's warbler	Locustella luscinioides	x	x		
	Banded demoiselle	Calopteryx splendens	?	x	x	
	Bluethroat	Luscinia svecica	?	x	?	x
15 -- 25	Great reed warbler	Acrocephalus arundinaceus	x	x	x	
	Sedge warbler	Acrocephalus schoenobaenus	x	x	x	
	Water rail	Rallus aquaticus	x	x	x	
	Beaver	Castor fiber	x	-	(x)	x
25 -- 35	Otter	Lutra lutra	x	x	x	x
	Black stork	Ciconia nigra	x	x	x	x
	Stock dove	Columba oenas	x	x	x	
	Bittern	Botaurus stellaris	x	x	x	x
> 35	Hen harrier	Circus cyaneus	x	x	x	x
	Western marsh harrier	Circus aeruginosus	x	x	x	x
	White stork	Ciconia ciconia	x	x	x	x
	Little grebe	Thachybaptus ruficollis	x	x	x	
	Black necked grebe	Podiceps nigricollis	x	x	x	
	Grey leg goose	Anser anser	x	x	x	
	Nortern shoveler	Anas clypeata	x	x	x	
	Common teal	Anas crecca	x	x	x	
		Anas querquedula	x	x	x	
	Black crowed night heron	Nycticorax nycticorax	x	x	x	
	Bearded tit	Panurus biarmicus	x	x	x	
	Common kingfisher	Alcedo attica	x	x	x	x
	Sand martin	Riparia riparia	x	x	x	
	Black tern	Chlidonias niger	-	-	-	x

Appendix 7 Selected species for grasslands

disp. Range	eng. Name	scientific name	Croatia	Bosnia-H.	Serbia-M.	hab. / birds directive
0-3	… grasshopper	Oedipoda caerulescens	x	x	x	
	mazarine blue	Polyommatus semiargus	x	x	x	
	dusky large bleu	Maculinea nausithous	-	-	-	(x)
	root vole	Microtus oeconomis	x	-	-	x
	Great crested newt	Triturus cristatus	x	-		x
		Triturus carnifex mac.		(x)	-	x
	Danube newt	Triturus dobrogicus	x?	x	x	x
	green frog complex	Rana kl. Esculenta	x	x	x	
	green toad	Bufo viridis	x	x	x	
	Natterjack	Bufo calamita	-	-	-	IV
3--7	common bleu	Polyommatus icarus	x	x	x	
	water vole	Arvicola terrestris	x	x	x	
	large copper	Lycaena dispar	x	x	x	x
	Orange tip	Anthocharis cardamines	x	x	x	
	Grass snake	Natrix natrix	x	x	x	
	European Tree Frog	Hyla arborea	x	x	x	
7 --15	Eurasian skylark	Alauda arvensis	x	x	x	
	sedge warbler	Acrocephalus schoenobaenus	x	x	x	
	blue throat	Luscina svevica	x	x	x	
	stone chat	Saxicola torquata	x	x	x	
	Yellow hammer	Emberiza citrinella	x	x	x	
	Yellow wagtail	Motacilla flava	x	x	x	
	Meadow pipit	Anthus pratensis	x	x	x	
	yellow bellied toad	Bombina variegata	x	x	x	x
	red bellied toad	Bombina bombina	x	-	-	x
15--20	great reed warbler	Acrocephalus arundiacea	x	x	x	
	Corn Bunting	Miliaria calandra	x	x	x	
	Black-tailed godwit	Limosa limosa	x	x	x	
	buzzard	Buteo buteo	x	x	x	
	red-backed shrike	lanius collurio	x	x	x	
	Badger	Meles meles	x	x	x	
> 35	Commun redshank	Tringa totanus	-	-	-	
	Eurasian curlew	Numenius arquata	-	-	-	
	Northern lapwing	Vanellus vanellus	x	x	x	
	… dragonfly	Gomphus flavipes	?			
	barn owl	Tito alba	x	x	x	?
	bittern	Botaurus stellaris	x	x	x	
	Corn crake	Crex crex	x	x	x	x

Appendix 8 Metadata Global and European datasets

Bartholomew: Europe digital map data

General Information		
	Year / Edition	August 2003
	Title of content	Europe map data
	Abstract	Pan-European dataset covering 52 countries, available either as 22 separate vector layers to provide a solution for geographic analysis, or as a high resolution raster with European styling. Alternatively both can be purchased together to provide the ultimate European coverage.
	Metadata source	http://www.bartholomewmaps.com/europe_data_products.htm
History dataset		
	History	Used to create the road maps in the Collins Road Atlas of Europe as well as reference maps for the Times and Collins range of world atlases
Dataset Identification		
	Extra keywords	See objects/attributes
	Maintenance	Regular updates
	Scale	1: 1.000.000
Spatial Information		
	Coordinate system	Longitude/latitude; decimal degrees
	Extent	From The Canaries in the west to the western edge of the Black Sea in the East. North Africa in the South to Northern Norway in the North. (Coordinates (long/lat) -32°W,-27°S to 32°E,71°N)
	Objects/attributes	ADM – Administrative layer CON – Contours and bathymetry. DRA – Drainage: permanent and impermanent. DES – Deserts: includes lava flows. HTS – Heights: summits, spot heights/depths and passes. NPK – National parks. PTS – Points: road numbers, airports, places of interest, etc LNS – Lines: escarpments, walls. RPK – Regional parks. RES – Reserves. RDS – Roads. RFS – Rail: railways and ferry routes. SAN – Sand. SCA – Scenic areas: only in UK URB – Major built-up-areas. WOO – Woodland: only GB at present. WAT – Water: lake, lagoon, marsh, glacier, etc. TOWN – Town stamps TEXT – Point and lines of all non town features DRATEXT – Lines with river names.
Distribution information		
	Copyright	Collins Bartholomew
	Distributor	Collins Bartholomew: http://www.bartholomewmaps.com/
	Availability	Example fees and licensing: Europe: 1:1.000.000, vector file, single use, year 1:£1100. Year 2, £275, etc. For more prices see website.
	Format	ARC/INFO: Vector - SHAPE file, MapInfo (tab or mif/mid). Raster – TIFF
	On-line delivery	Internet license possible
	Ordering process	For orders contact Collins Bartholomew.

DCW: Digital chart of the world

General Information		
	Year / Edition	1997
	Title of content	DCW
	Abstract	The Digital Chart of the World is a worldwide basemap of coastlines, international boundaries, cities, airports, elevations, roads, railroads, water features, cultural landmarks, and much more. It is the most detailed global database providing consistent treatment of geographic information worldwide, and is the best source of data for many areas of the globe.
	Metadata source	http://www.maproom.psu.edu/dcw/dcw_about.shtml
History dataset		
	History	The Digital Chart of the World (DCW) is an Environmental Systems Research Institute, Inc. (ESRI) product originally developed for the US Defense Mapping Agency (DMA) using DMA data. The DCW 1993 version at 1:1.000.000 scale was used. The original format of the DCW from ESRI has 2094 separate ARC/INFO workspaces. Each workspace is bounded by latitude and longitude, 5-by-5 degrees. Each can contain up to 25 different thematic layers. The original workspaces were complied into countries, territories and states; the server contains about 340 of these areas, from the original 2094 workspaces. Parts of the tiles were aggregated one country at a time, and each country-boundary coverage was used as a "cookie cutter" to select the thematic data according to country boundaries.
Dataset Identification		
	Maintenance	THIS DATABASE IS NOT UP TO DATE
	Scale	1:1.000.000
	Restrictions	Acknowledge the source of the data in all publications and applications.
Spatial Information		
	Coordinate system	WGS84 - ETRS89
	Extent	Global
	Temporal coverage	1993
	Objects/attributes	More than 200 attributes are organized into 17 thematic layers with text annotation for cities, mountains, and lakes.
Distribution information		
	Copyright/	ESRI
	Distributor	ESRI
	Availability	Available on CD or download, no password
	Format	ARC/INFO export file
	On-line delivery	Via http://www.maproom.psu.edu/dcw/dcw_about.shtml

USGS GTOPO30 Digital Elevation Model

General Information		
	Year / Edition	1996: Version 1
	Title of content	DTM + DTM_slope_dgr
	Abstract	GTOPO30 is a global digital elevation model (DEM) resulting from a collaborative effort led by the staff at the U.S. Geological Survey's EROS Data Centre. Elevations in GTOPO30 are regularly spaced at 30-arc seconds (approximately 1 kilometer). GTOPO30 was developed to meet the needs of the geospatial data user community for regional and continental scale topographic data. This release represents the completion of global coverage of 30-arc second elevation data that have been available from the EROS Data Centre beginning in 1993. Several areas have been updated and the entire global dataset has been repackaged, so these data supersede the previously released continental datasets. Comments from users of GTOPO30 are welcomed and encouraged.
	Metadata source	http://edcdaac.usgs.gov/gtopo30/README.asp
	Documentation	http://edcdaac.usgs.gov/gtopo30
History dataset		
	History	GTOPO30 is based on data derived from 8 sources of elevation information, including vector and raster datasets. The following table lists the percentage of the global land surface area derived from each source (a full description of each source is provided below): Source — % of global land area Digital Terrain Elevation Data — 50.0 Digital Chart of the World — 29.9 USGS 1-degree DEM's — 6.7 Army Map Service 1:1,000,000-scale maps — 1.1 International Map of the World 1:1,000,000-scale maps — 3.7 Peru 1:1,000,000-scale map — 0.1 New Zealand DEM — 0.2 Antarctic Digital Database — 8.3
Dataset Identification		
	Maintenance	No information available
	Scale	1:1.000.000 to 1:2.000.000. The horizontal grid spacing is 30-arc seconds
	Restrictions	Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government
Spatial Information		
	Coordinate system	WGS84/ETRS89: The horizontal coordinate system is decimal degrees of latitude and longitude referenced to WGS84. The vertical units represent elevation in meters above mean sea level. The elevation values range from -407 to 8,752 meters.
	Extent	GTOPO30 is a global dataset covering the full extent of latitude from 90 degrees south to 90 degrees north, and the full extent of longitude from 180 degrees west to 180 degrees east
	Temporal coverage	GTOPO30 was developed over a 3 year period during which continental and regional areas were produced individually. As such, processing techniques were developed and refined throughout the duration of the project. Although the techniques used for the various continental areas are very similar, there were some differences in approach due to varying source material. More details about data development for several of the continental areas are reported by Verdin and Greenlee (1996), Bliss and Olsen (1996), and Gesch and Larson (1996).
	Objects/attributes	Grid: value height in meters

Distribution information		
	Copyright	EDC DAAC, U.S. Geological Survey, EROS Data Centre (The EDC DAAC was established as part of NASA's Earth Observing System (EOS) Data and Information)
	Distributor	U.S. Geological Survey's EROS Data Centre
	Availability	GTOPO30 is available electronically through an Internet anonymous File Transfer Protocol (FTP) account at the EROS Data Centre (at no cost). Procedures for Obtaining Data: http://edcdaac.usgs.gov/gtopo30/README.asp
	Format	**DEM file**: The DEM is provided as 16-bit signed integer data in a simple binary raster. There are no header or trailer bytes imbedded in the image. The data are stored in row major order (all the data for row 1, followed by all the data for row 2, etc.). **Source Map** (.SRC): The source map is a simple 8-bit binary image which has values that indicate the source used to derive the elevation for every cell in the DEM. The source map is the same resolution and has the same dimensions and coordinate system as the DEM. For other files see the readme.asp
	On-line delivery	http://edcdaac.usgs.gov/gtopo30/gtopo30.asp To facilitate electronic distribution, GTOPO30 has been divided into 33 pieces or tiles. Data for each GTOPO30 tile are distributed electronically as a compressed tar file.

Elevation Europe Images

General Information		
	Year / Edition	2003
	Title of content	Elevation1x1, elevation3x3, elevation9x9, hillshade1x1: tiff files
	Abstract	This is a 256 color image of global digital elevation model (DEM) derived from a horizontal grid. Several resolutions are available: 30 arc seconds (approximately 1 km^2), 3 km^2 and 9 km^2.
	Metadata source	Via http://dataservice.eea.eu.int/dataservice/
	Documentation	
History dataset		
	History	Methodology: The data set was compiled by EEA and is derived from the GTOPO30 dataset. The DTM was converted to raster (georeferenced tiff) using Arcview and Grid Pig extension. The Caspian Sea border, the Africa depression and some areas from the Netherlands, all under sea level were corrected. The DTM was hillshaded using ArcMap and Spatial Analyst using following parameters: Azimuth: 315, Altitude: 45, Model shadows: Yes, Z factor: 10, Cell size: 1000 m.
Dataset Identification		
	Keywords	Elevation, DEM, geographic
	Maintenance	No information available
	Scale	Resolutions available: 1x1 km, 3x3 km and 9x9 km grids
	Restrictions	This data, accompanied by its metadata, is freely available subject to acknowledgement of the source(s). For EEA the acknowledgement should read: © EEA, Copenhagen, 2003.
Spatial Information		
	Coordinate system	LAEA
	Extent	EU 25, EFTA 4, AC 3, Albania, Armenia, Belarus, Bosnia and Herzegovina, Croatia, FR Yugoslavia, Georgia, Macedonia- the Former Yugoslav Republic of, Moldova- Republic of, Russian Federation, Serbia and Montenegro, Ukraine.
	Temporal Coverage	No information available
	Objects/attributes	Grid cells with value for altitude
Distribution information		
	Source	Data available from U.S. Geological Survey, EROS Data Center, Sioux Falls, South Dakota
	Creator	European Environment Agency
	Distributor	European Environment Agency - Data service
	Availability	Available via download, no password. Last upload: 08/03/2004
	Format	1 km x 1 km, 3 km x 3 km, 9 km x 9 km, Hillshade 1 km x 1 km: all data in ZIP compressed TIFF format. .prj file: ArcGis projection file
	On-line delivery	Via http://dataservice.eea.eu.int/dataservice/

Biogeographical regions, Europe 2001

General Information		
	Year / Edition	July 2002
	Title of content	Biogeo_01 or BRME (Biogeographical Regions Map of Europe)
	Abstract	The bio-geographic regions dataset contains the official delineations used in the Habitats Directive (92/43/EEC) and for the EMERALD Network set up under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).
	Metadata source	Via http://dataservice.eea.eu.int/dataservice/
	Documentation	In .pdf format: Basic principles of the Biogeographical Regions Map creation and overview of its development.
History dataset		
	History	In the absence of a clear definition of the Biogeographical Regions mentioned in the text of the Habitats Directive, the Scientific Working Group (SWG) of the directive agreed upon the following principles for the creation of the Biogeographical Regions Map: • Only regions related to the terms mentioned in art. 1 c (iii) are to be mapped; as a consequence no 'sub-classes' are considered such as 'sub-continental, sub-alpine, hemi-boreal, etc. • The mapping procedure is based on an interpretation of the digital version of the 'Map of Natural Vegetation of the member countries of the European Community and of the Council of Europe' (Noirfalise A., 1987). • The final map is only to be used at a small scale (± 1:10.000.000 or smaller) • As a consequence the basic background natural vegetation map (scale 1:3.000.000) needs to be generalized • Generalization is performed by removing smaller 'islands' of different regions within a major region and by attributing the 'azonal units' of the map to the neighbouring Biogeographical Region.
Dataset Identification		
	Keywords	Macaronesia, Mediterranean, Pannonian, Steppic, Natlan, ETC/NPB, DISMED, biogeographical, region, Alpine, Anatolian, Arctic, Atlantic, Black Sea, Boreal, Continental, geography
	Maintenance	No information available
	Scale	1:10.000.000
	Restrictions	See EEA dataservice- terms of use
Spatial Information		
	Coordinate system	LAEA
	Extent	EU 25, EFTA 4, AC 3, Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, FR Yugoslavia, Georgia, Kazakhstan, Macedonia- the Former Yugoslav Republic of, Moldova-Republic of, Monaco, Russian Federation, San Marino, Ukraine (Pan European coverage (Russian Federation covered to Ural. Parts of Georgia, Armenia, Azerbaijan and Kazakhstan)
	Objects/attributes	BGCD: Bio-geographic Region code Name: Name of Bio-geographic Region
Distribution information		
	Source	European Topic Centre on Nature Protection and Biodiversity (ETC-NPB)
	Distributor	European Environment Agency Data service
	Availability	Available via download, no password
	Format	Coverage in ARC/INFO Export file, tables in ASCII Delimited, Dbase IV, Access 2000 or Excel.
	On-line delivery	Via http://dataservice.eea.eu.int/dataservice/

CORINE Biotopes

General Information		
	Year / Edition	Version April 2000
	Title of content	biotopes_pan
	Abstract	The CORINE biotopes (Version 2000) database is an inventory of major nature sites. The database began under the CORINE Biotopes project to enhance reliable and Accessible information about vulnerable ecosystems, habitats and species of important as background information for Community environmental assessment.
	Metadata source	Via http://dataservice.eea.eu.int/dataservice/
	Documentation	The original documentation of the dataset and its compilation is available in the following report: CORINE Biotypes - The design, compilation and use of an inventory of sites of major importance for nature conservation in the European Community. The data collection is also described in report: CORINE Biotopes Sites - Database Status and Perspectives 1995.
History dataset		
	History	CORINE data are based on field studies and summaries of existing data base information. The requirement for reliable and Accessible information on the location and status of the ecosystems, habitat types and species in need of protection is fundamental to the implementation of nature conservation policy. To be applicable on the European level, the nature information must be consistent in every region. The CORINE Biotopes inventory aims at identifying the sites of major importance for nature conservation on the European level (Biotopes sites). The consistent and comparable information on these sites is compiled and recorded into the Biotopes sites data-base. One of the main aims is to make the information easily applicable for environmental policy-makers. It was expected that the main user of the information would be the European Commission, but the information proved to be useful also for other international organisations. On the national level the information has been useful to the environmental administration, environmental policy planning, research, and is also used by non-governmental organisations and others.
Dataset Identification		
	Keywords	Biotope, species, geographic
	Maintenance	The Biotope database, which is a part of a large information system on nature for Europe, is a dynamic database. Updates occur regularly, and new data are added. Last update: 28/01/2003
	Scale	Non applicable
	Restrictions	See EEA dataservice- terms of use
Spatial Information		
	Coordinate system	LAEA
	Extent	EU 25 (with the exception of Austria, Sweden, Cyprus, Malta, Slovenia) , AC 3 (with the exception of Turkey)
	Objects/attributes	CORINE biotopes consists of many tables containing information on: Site code, Date, Update, Complex code, Respondent, Site name, Site-complex, Sub-site codes, Designated areas, Region name, District name, Region code, Surface area, Longitude and latitude, Altitude, Habitat codes, Habitat cover, Designation codes, Motivation, Species, Site description, Site boundaries

Distribution information		
	Copyright	Member states
	Creator	The European Topic Centre on Nature Protection and Biodiversity (April 2000).
	Distributor	European Environment Agency - Data service
	Availability	The datasets and tables cannot be downloaded without permission from EEA. The agreement "Corine biotopes" which the applicant will have to sign, will appear when requesting the download of the dataset.
	Format	ARC/INFO: point data. Many tables available in ASCII Delimited, Dbase IV, Access (2000) or Excel.
	On-line delivery	Via http://dataservice.eea.eu.int/dataservice/

CORINE: Landcover 100m grid

General Information		
	Year / Edition	2000
	Title of content	Corine44_100m, CLC90 grid (GISCO LCEUGR100)
	Abstract	The CORINE land cover database provides a pan-European inventory of biophysical land cover, using a 44 class nomenclature. CORINE land cover is a key database for integrated environmental assessment. The main objective of the CORINE Land Cover Directory is to provide the potential users of the CORINE Land Cover data with information describing the CORINE Land Cover project in each Member state. The CORINE Land Cover Directory is based on the information sheets on CORINE Land Cover prepared by the former CORINE Land cover technical Unit, where administrative and technical information regarding each national team was gathered. These information sheets were sent out by the ETC/LC Technical Unit to each national team for corrections and update and joined to produce the CORINE Land Cover Directory.
	Metadata source	http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=309
History dataset		
	History	New techniques of data obtaining and processing contributed to objectification of the available knowledge of landscape. Remote sensing methods make possible to perceive the visible layer of the material contents of landscape, which we identify by means of physiognomic and morphostructural features as landscape cover. Simultaneously the physiognomic aspect of objects often indicates their material contents or function. Main stages of the used method: 1. preliminary work, 2. Production of false colour images on scale of 1:100.000, 3. Computer-aided photo-interpretation / Delineation / identification / Controlling the quality of the photo-interpretation 4. Digitisation 5. Validation of the database.
Dataset Identification		
	Scale	1:100.000 (100m pixel size, smallest mapping unit 25ha.)
	Restrictions	The data files for this dataset are password protected. In order to receive the password, an agreement signature form needs to be filled in, it can be found under the "Downloads" tab on web.
Spatial Information		
	Coordinate system	LAEA
	Extent	Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Spain.
	Temporal coverage	The CORINE Land Cover inventory was performed in a 10 years period from 1986 to 1996
	Objects/attributes	1 1.1.1 Continuous urban fabric 2 1.1.2 Discontinuous urban fabric 3 1.2.1 Industrial or commercial units 4 1.2.2 Road and rail networks and associated land 5 1.2.3 Port Areas 6 1.2.4 Airports 7 1.3.1 Mineral extraction sites 8 1.3.2 Dump sites 9 1.3.3 Construction sites 10 1.4.1 Green urban areas 11 1.4.2 Sport and leisure facilities 12 2.1.1 Non-irrigated arable land

		13 2.1.2 Permanently irrigated land 14 2.1.3 Rice fields 15 2.2.1 Vineyards 16 2.2.2 Fruit trees and berry plantations 17 2.2.3 Olive groves 18 2.3.1 Pastures 19 2.4.1 Annual crops associated with permanent crops 20 2.4.2 Complex cultivation patterns 21 2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation 22 2.4.4 Agro-forestry areas 23 3.1.1 Broad-leaved forest 24 3.1.2 Coniferous forest 25 3.1.3 Mixed forest 26 3.2.1 Natural grassland 27 3.2.2 Moors and heath land 28 3.2.3 Sclerophyllous vegetation 29 3.2.4 Transitional woodland-scrub 30 3.3.1 Beaches, dunes, sands 31 3.3.2 Bare rocks 32 3.3.3 Sparsely vegetated areas 33 3.3.4 Burnt areas 34 3.3.5 Glaciers and perpetual snow 35 4.1.1 Inland marshes 36 4.1.2 Peat bogs 37 4.2.1 Salt marshes 38 4.2.2 Salines 39 4.2.3 Intertidal flats 40 5.1.1 Water courses 41 5.1.2 Water bodies 42 5.2.1 Coastal lagoons 43 5.2.2 Estuaries 44 5.2.3 Sea and ocean 49 Missing Data
Distribution information		
	Copyright	CEC member states
	Distributor	European Environment Agency
	Availability	EEA maintains the aggregated European dataset for CORINE Land Cover. Information concerning individual national datasets should be requested from the National Reference Centre. Information concerning progress on the update of CORINE Land Cover through the project CLC2000 is available from ETC Terrestrial Environment.
	Format	ARC/INFO grid: 60 Mb
	Ordering process	Via European Environment Agency

CORINE: Land Cover 250m grid

General Information		
	Year / Edition	Version 12/2000 (last update 22/08/02) (extended coverage in comparing with version 06/1999)
	Title of content	CLC90 250m
	Abstract	The CORINE land cover database provides a pan-European inventory of biophysical land cover, using a 44 class nomenclature. It is available on a 250m by 250m grid database which has been aggregated from the original vector data at 1:100 000. CORINE land cover is a key database for integrated environm. assessment.
	Metadata source	http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=571
	Documentation	More documentation available via website
History dataset		
	History	The dataset is made available on a 250m by 250m grid database which has been aggregated from the original vector data at 1:100.000. History of CORINE landcover project per country available on http://dataservice.eea.eu.int/dataservice/other/land_cover/lcsource.asp

Dataset Identification		
	Keywords	Landcover, DISMED, CORINE
	Maintenance	Information concerning progress on the update of CORINE Land Cover through the project CLC2000 is available from ETC Terrestrial Environment
	Scale	250 x 250 meter Geographic accuracy: All features were digitised from an interpretation of satellite image printouts of the scale 1:100 000. 150 m. positional accuracy (according to CLC specifications), 25 ha minimum mapping unit.
	Restrictions	The data files for this dataset are password protected. In order to receive the password, an agreement signature form needs to be filled in, it can be found under the "Downloads" tab on web.
	Products	Maps produced with CORINE 250 version 06/99: • Agricultural abandonment of grassland • Agricultural areas • Agricultural intensification of grassland • Areas in EU eligible under the regional Objective of the Structural Funds (1994-1999) • Areas remote from urban and transport pressures • Areas with relatively little influence from urbanisation, transport or intensive agriculture • Built-up land by major river catchment area • Comparison of population distribution by administrative unit and by land cover unit • Data availability in EU for hot-spots analysis • Deposition of sulphur in the Black Triangle, 1997 • Designated Areas under pressure from agricultural areas • Designated Areas under pressure from railways • Designated Areas under pressure from roads • Designated Areas under pressure from urban areas • Distribution of major habitats • Dominant landscapes • EUNIS habitat types per biogeographic region • EUNIS habitats based on CORINE land cover • Forest and semi-natural area per inhabitant by administrative unit • Forest around capitals in Europe • Forested areas • Forests • Fragmentation by major roads of large forest complexes (>600 km²) • Fragmentation by urbanisation, infrastructure and agriculture • Fragmentation of large forests • Geographic view of landcover and its 44 classes • Grassland and sparsely vegetated areas • Population density and land cover in coastal areas • Pressures by urban areas and transport network • Ratio of forest and semi-natural areas to agriculture and urban areas by administrative unit • Regional coincidence of some environmental pressures and impacts (hot-spots) • Regional predominant pressures on coniferous forest l • Regional predominant pressures on dry grassland • Regional predominant pressures on wet grassland • Urban, rural, coastal and mountain areas in Europe • Wetlands and water bodies • Wooded species • Zoom in on urban and rural areas

Spatial Information		
	Coordinate system	LAEA
	Extent	EU 15, AC 13 (with the exception of Cyprus, Malta, Turkey), Albania, Andorra, Bosnia and Herzegovina, Macedonia- the Former Yugoslav Republic of. Coastal zone of Tunisia and Northern Morocco also covered.
	Temporal coverage	The CORINE Land Cover inventory was performed in a 10 years period from 1986 to 1996.
	Objects/attributes	See CORINE 100m grid
Distribution information		
	Copyright	CEC member states
	Creator	The European Topic Centre on Terrestrial Environment
	Distributor	European Environment Agency
	Availability	Available via download, password needed (also Version 06-1999) - EEA maintains the aggregated European dataset for CORINE Land Cover. Information concerning individual national datasets should be requested from the National Reference Centre -Information concerning progress on the update of CORINE Land Cover through the project CLC2000 is available from ETC Terrestrial Environment.
	Format	ARC/INFO Grid export file
	On-line delivery	Via http://dataservice.eea.eu.int/dataservice/

GLC2000: Global Land Cover dataset

General Information		
	Year / Edition	1.0 (15/05/03)
	Title of content	GLC2000
	Abstract	The global Land Cover dataset is a product of "The Global Land Cover 2000 database. European Commission, Joint Research Centre, 2003. http://www.gvm.jrc.it/glc2000." It is realized by the harmonization of all the regional products, into a full resolution global product, with a generalized legend. The driving force behind the GLC2000 project is the Implementation of the ecosystem-related International Conventions, such as FCCC, CCD or CBD. These are signed by countries, and therefore, although there is a need for a global understanding of the environment, all environmental assessments and actions for policy implementation must be consistent at the *national level*. The global land-cover information to be provided by GLC 2000 must also be consistent at the national level. The FAO Land Cover Classification Scheme (LCCS) offers the framework by which the various scale levels can be inter-connected without defining every single category of the legend.
	Metadata source	http://www.gvm.jrc.it/glc2000
	Documentation	The Land Cover Map for Southern Europe in the Year 2000. J-F.Pekel, N.Vancutsem, P.Defourney, J-L.Champeaux, C.Gouveia, A.Lobo, S.Griguolo, A.Perdigao, E.Bartholomé. GLC2000 database, European Commission Joint Research Centre, 2003. http://www.gvm.jrc.it/glc2000
History dataset		
	History	Data source: SPOT Vegetation The general objective is to provide for the year 2000 a harmonized land cover database over the whole globe. The year Two Thousand is considered as a reference year for environmental assessment in relation to various activities, in particular the United Nation's Ecosystem-related International Conventions. To achieve this objective GLC2000 makes use of the VEGA 2000 dataset: a dataset of 14 months of pre-processed daily global data acquired by the VEGETATION instrument on board the SPOT 4 satellite, made available through a sponsorship from members of "the VEGETATION programme", including JRC. Derived dataset: Vegetation quality index
Dataset Identification		
	Keywords	Global Land Cover, SPOT Vegetation
	Maintenance	No information available
	Scale	Resolution: 1km at Equator
	Restrictions	Free of charge for non-commercial use, provided it is properly referenced.
Spatial Information		
	Coordinate system	Lat/Long WGS84
	Extent	World
	Temporal coverage	01/01/00 - 31/12/00
	Objects/attributes	http://www.gvm.jrc.it/glc2000/legend.htm Land Cover Classification Scheme(LCCS) based on FAO LCCS tool: http://www.africover.org/lccs.htm **Cultivated areas** • Cultivated and managed terrestrial area(s) • Cultivated aquatic or regularly flooded area

		Natural (semi-) vegetation
		• Natural and semi-natural terrestrial vegetation
		  o Woody
		  o Trees
		  o Shrubs
		  o Herbaceous
		  o Lichens & mosses
		• Natural and semi-natural aquatic or regularly flooded vegetation
		  o Woody
		  o Trees
		  o Shrubs
		  o Herbaceous
		Artificial surfaces
		Bare areas
		Water, snow, ice

Distribution information		
	Copyright	GLC2000 partners
	Distributor	GLC2000 website
	Compiler	European Commission Joint Research Centre
	Availability	Downloadable from internet http://www.gvm.jrc.it/glc2000/ProductGLC2000.htm In order to gain Access to the download site, you will have top fill in some general information about yourself.
	Format	Various formats
	On-line delivery	All data for all **regional** windows of the world, as well as the **global** landcover classification are available for download in various formats, both at full resolution, and in the form of a poster.

PELCOM

General Information		
	Year / Edition	2000
	Title of content	PELCOM
	Abstract	PELCOM (the Pan-European Land Cover Monitoring project) is a 1-km pan-European land cover database. The PELCOM project is aimed at developing a consistent methodology to derived land cover information on a European scale for environmental monitoring based on the integrative use of multi-spectral and multi-temporal NOAA-AVHRR satellite imagery and ancillary data. PELCOM is a three-year project as a shared cost action under the Environment & Climate section of the European Union 4th Framework RTD Programme
	Metadata source	http://cgi.girs.wageningen-ur.nl/cgi/projects/eu/pelcom/public/index.htm
	Documentation	PELCOM Homepage: http://cgi.girs.wageningen-ur.nl/cgi/projects/eu/pelcom/
History dataset		
	History	Data Sources: One of the data sources for the PELCOM Project was the MARS (Monitoring Agriculture by Remote Sensing) archive provided by the Space Applications Institute (SAI) of the Joint Research Institute (JRC). This archive contains pre-processed daily multi-spectral mosaics of AVHRR (Advanced Very High Resolution Radiometer) images covering the European continent. Normalized Difference Vegetation Index (NDVI) composites are also available in these archives, but they were considered inadequate for the PELCOM project due to the low geometric accuracy of the single AVHRR images. As a result, the NDVI monthly maximum value composites for the year of 1997 available from DLR (Deutches Zentrum für Luft und Raumfahrt) were used as the main data source for the classification process. Various ancillary data sources have also been used as reference datasets in the PELCOM Project. Some examples are the Digital Chart of the World (DCW) and the CORINE (Coordination of Information on the Environment) land cover database.
Dataset Identification		
	Maintenance	The database could be updated periodically.
	Scale	1:1.000.000 (1000m grid)
	Restrictions	Acknowledge the source of the data in all publications and applications.
Spatial Information		
	Coordinate system	Albers Conical Equal Area- WGS_1972
	Extent	EU 15
	Temporal coverage	1996-1999
	Objects/attributes	Landcover classes: • 0 FOREST :1 Coniferous forest - 2 Deciduous forest - 3 Mixed forest • 20 GRASSLAND: 21 Natural grassland - 22 Cultivated grassland • 30 ARABLE LAND - 31 Non-irrigated arable land - 33 Winter crops - 34 Summer crops - 32 Irrigated arable land • 40 PERMANENT CROPS • 50 SHRUBLAND • 60 BARREN LAND -61 Rocks -62 Bare soil • 70 PERMANENT ICE AND SNOW • 80 WETLANDS • 90 WATER BODIES

		• 100 URBAN AREAS • 110 DATA GAPS
Distribution information		
	Copyright	Alterra on behalf of many organisations
	Distributor	Centre for Geo-information, Alterra, Wageningen UR
	Availability	CD-ROM free of charge or downloadable.
	Format	ARC/INFO grid
	On-line delivery	Downloadable via: http://cgi.girs.wageningen-ur.nl/cgi/projects/eu/pelcom/index.htm
	Ordering proces	Via Centre for Geo-information, Alterra, Wageningen UR

Appendix 9 Proposal for gathering field work

PROPOSAL OF PROJECT FOR FIELD INVESTIGATION ON SPECIFIC HABITATS IN SAVA RIVER BASIN

Concept

CEPRES, Sarajevo, 23 – 6 – 2005

Introduction

Sava river builds up the main part of natural border between Croatia, Bosnia and Herzegovina and Serbia with Montenegro. Due to this fact there is a huge necessity to make entire region around downstream of Sava river an object of joint transboundary management and planning. An urge to develop joint work and cooperation is the most obvious when it comes to nature conservation and management issues. Specific forms of life, of flora as well as of fauna, don't recognize political borders. Instead, they are connected through the similar ecological framework that exist along Sava river. In order to establish functional management of space around Sava river, it is important for each of these countries to have data on distribution of species and communities in this region.

Catchment area of Sava river posses high level of habitat's heterogenity. Tributaries of Sava river spring mostly on the peaks of high mountains and flow through the canyons that have been built eons ago, especially south one tributaries, reaching at its end broad valley of Sava river.

If we focus our attention onto the broad valley of the Sava and its tributatries, joint, which are often boundary areas, there are habitat's types that are caused and maintained through the periodic inundation by river water or the high level of underground water or presence of surface watercourses. Due to these facts developed are reedbeds, marshes and bogs, higrophilous meadows, periodically flooded alder forests and oak-hornbeam forests.

Countries of these region have reached different levels of knowledge and arrangement of existing biodiversity data. For example, in Bosnia and Herzegovina, despite of its own expert capacities, weren't developed mechanisms for inventarisation of flora and fauna, habitat types and ecosystems, which is required for implementation of Habitat and Bird Directive, as well as Natura 2000. Red Lists for certain groups of organism exist only in form of scientific proposals. This proccess is moving swiftly forward in the Serbia with Montenegro, in Croatia it is mainly completed.

Conservation and management of biodiversity is unequally developed, too. In Croatia, as a part of national network of protected areas, exists enormous space of Park of Nature - Lonjsko polje. In the valley of Sava river, on the teritory of Serbia with Montenegro, there are two large protected areas (Zasavica and Obedska bara), while in Bosnia and Herzegovina there is only one protected area that is situated in the valley of Sava river – Bird Reserve Bardača.

In order to accomplish intergrated transboundary management of Sava river valley, it is neccesary to :

- Determine current state of existing habitat types (where, how large, what quality)s
- Identify areas that should be an object of conservation
- Establish ecological network of protected areas

In order to accomplish these in the region that hasn't been managed as a unique space, it is neccesary to harmonize levels of biodiversity investigation between countries. This can be managed through the field reserach that should:

- Provide new insights on species or communities distribution
- Provide new insights in the area and quality of habitat types
- Innovate and extend existing data on mentioned objectives

General problem

While we were gathering data on animal, plant species and plant communities for the project Intergrated management of Sava river catchment area, it became obvious to us strong need to undertake new field investigation. Literature data on distribution of species that have certain conservation status in these countries do exist till some extent. But, as previous research has shown, existing data aren't sufficient. By application of suggested method that is based on putting a focus on a small number of species and communities with exact data on its distribution, abundancy, dispersal capacity etc., it was clear that there is no solid base for establishment of ecological network in the Sava river basin.

The approach of Eecological networks offers a framework ing represents foundation offor future management. In the approach of planning activities that could be highly effective, due to the development based on the Sava river basin potentials, recognition of areas needed to secure survival of protected species and habitats is the first step.

Firmly supporting idea of ecological network's establishment as a foundation to the further intergrated management, it is important to emphasize that Sava river in its midle and down part of flow builds up wide alluvial plain, which provides optimal conditions to the following types of ecosystems:

- On deep ilimerized soil wide spread are mixed forests of oak and hornbeam. These forests have undergone strong degradation process on the right shore of Sava river and its plain has been converted into arable land. According to the EUNIS classification this forest type is described as a G1.A1B.

- Moist meadows with dominancy of *Molinia coerulea* are often flooded with water coming from Sava river, its tributaries or from trenches of irrigation system. From sindynamic point of view, moist meadows turn into reedbeds or marshes and bogs, which are well developed on the places with water retention on the surface. According to the EUNIS classification these habitat types are described as following: E3.34, E3.43, E3.44, E3.46, E3.51.

- Shores of watercourses are inhabited with communities of ash and snowdrop, communities of willow, white poplar and alder. These types of ecosystem are habitats of many protected migratory birds, nesting birds, amphibians, reptiles, mammals etc. Classes according to the EUNIS

classification these habitat types are described as following : G1, G1.1, G1.11, G1.2, G1.213, G1.223.

- Natural habitat types like ponds, bogs, marshes and flooded forests are under immense pressure, due to attempts to increase arable land and to turn this area into it. According to the EUNIS classification these habitat types are described as following :C1, C1.2, C3, C3.2, C3.23, C3.24, C3.25, C3.511, D2.33, D2.3D, D4.15, D4.1F, D5, D5.3.

Protection of these ecosystems is a prerequisite for survival of species that are bounded to them thanks to their ecological valency.

Countries of the region have not completed biotop maps and identified Natura 2000 sites yet, because of that current data are not sufficient for the recognition of core areas and corridors in the ecological network to be. It is necessary to emphasize that efficiency of future network will depend exlusively on good coverage with data for entire Sava river basin.

During our previous work, it became obvious that lacking of distribution maps for species, which are important to the establishment of future ecological network, is a tremendous problem. Proposed project includes drafting of distribution maps for such species.

Sustainability and contribution of results to the PIN-MATRA

After gaining complete insight into existing data and identification of current needs, proposed project is ment to be a first steep toward fullfilment of PIN-MATRA asignments.

Proposed project will considerably contribute to the results of PIN-MATRA project by means:

1. physical aspect : PIN-MATRA project implies field investigation in Croatia and Serbia with Montenegro. General target of PIN-MATRA project is to establish solid foundation for the intergrated management . Due to this fact, it is clear that lack of data from one part of teritory block the highest efficiency achievment. Proposed project will supply entering data for three countries between which Sava river makes natural borderline.
2. timing aspect : PIN-MATRA project beginns in September, 2005. According to the former joint efforts and training activities led by Altera, there is a strong possibility to start field investigation already in August. On that way PIN-MATRA project should acquire higher efficiency.

General target

General target of proposed project is to gather scientific data on distribution of species whose conservation requires establishment of protected areas in the regionbroad valley of the Sava and its tributaries where , that is Sava river basin makes also the boundary area between Croatia, Serbia with Montenegro and Bosnia and Herzegovina.

Investigation area

Investigation area of proposed project includes teritory around midle- and downflow of Sava river. This teritory represents natural unit that has high significance to the each of the countries : Croatia, Serbia with Montenegro and Bosnia and Herzegovina. Main attribute of these entire area are alluvial and higrophilous habitat types, which are inhabited by many species concerned with European Directives, among others by otter (*Lutra lutra lutra).*

Methods

In the project will be applied appropriate methods of field work investigation. Investigation in the field will be realized at the preliminary chosen sites that are situated on the teritory of Sava river basin in Croatia, Bosnia and Herzegovina and Serbia with Montenegro.

Field work should include

- recognition of habitat types on the basis of existing plant communities, as well as determination of what types of ecosystem are present at the site
- determination of abundancy and coverage of indicator plant species, in order to determine habitat's quality
- presence/absence detection of chosen birds, mammals, amphibian and reptiles

In the same time project predicts establishment of a GIS-database that will include data collected during field investigation. Database will contain all relevant data, for example: site, type of habitat, indicator plant species along with assessment of its coverage values, population of animals along with assessment of its size, date etc. On this way it will be easily to prepare distribution maps at least for this area.

Criteria for selection of sites

Selection of sites will take into account following criteria:

1. size of single site shouldn't be less than 100 ha;
2. site should comprise those habitat's types whose conservation requires establishment of protected areas. Project is foused at the different types of wetland river-related habitat typess;
3. selected will be the sites, which thanks to its geographical position, converge in the broad valley of the Sava river and tributaries (of which a large part isto the borderland between three neighbouring countries);
4. during process of site's selection it will be analized existing literature data on distribution of species and communities. Selected will be those sites that have higher quality, when it comes to the chosen indicator values; ??? Quality of areas is often not known; this is something that you want to map!! We suggest to leave this criterium out.
5. beside of areas that are allready an object of some protection's regime, it will be included sites whose size and quality ensureshas potential conditions for the sustainabile management of wetlands.

Criteria for selection of species

Contrary to the former praxis in the countries of this region, field investigation wouldn' t comprise every detected species, but species, whose survival requires habitat' s conservation. In the beginning, species selection will be based on focusing species concerned with Habitat and Bird Directives, afterwards these species

In order to establish efficient ecological network it will be necessary to select groups of species and to have in mind :

- available knowledge of species
- indicator value for river ecosystems
- distribution habitat preference, area requirement for viable populations and dispersal capacityrange of species

Investigation approach that includes selection only of targeted species, should enable efficient fulfillment of project assignment.

Species, whose distribution will be explored, should match following criterion:

- ! to be useful for network assessment (not too common, not too rare)
- ! to have stable population in the investigation area
- ! to be easily monitored

Selection of species should comprises scientific knowledge on :

- Required area for populations (ha)
- Disperal capacity (km)

Selection of species that have different space area requirements will simplify recognition of core areas and possible corridors, as a basis for ecological network.

In the goal of proper selection of indicator plant species, following category will be consider

- (OBL) Obligate Wetland Occurs almost always (estimated probability 99%) under natural conditions in wetlands.

Methods for the inventory of the agreed species

In order to assess quality of habitat types along the Sava river, we shall make an inventory of certain characteristic and indicator plant species.Thus, our first step should be choosing the appropriate plant species, which are indicator for a good quality of habitat. Further more, in the field will be detected its presence and maped with GPS.
Inventory of animal species will be managed by recording number of detected specimens. Birds inventory will beside number of detected specimens include number of couples, with respect to the number of detected nests.

Method to describe general characteristics of the area

In accordance with a form that is applied in the section Working schedule:

- On the basis of topographic figures there should be determined size of each site
- Percentage of watercourses coverage and ecosystem's types, based on the field observation.
- Georeferences by means of GPS
- Protection level according to the official records of national CDDA bases
- Ownership, according to the field observation

Schedule of project activities

In order to achieve effective field work it is neccessary to:

1. place the research activities at the time of active life of chosen species,
2. adjust content and investigation to the chosen species.

Thus it is necessary to set a start of field work already in August, 2005. Field work suppose to be step up througout autumn and first overview of collected data should be prepared in April and May, 2006. Data gathering would be continued during spring.

When it comes to the some of bird species, in the autumn is feasable to detect number of specimens, and in the spring time number of bird's couples that nest on the investigation area.

WORK PLAN

1. Concept list of species that will be inventoried

a) Concept list of plant species

Butomus umbellatus - reedbeds	Alnus glutinosa – alder forests
Carex distans - shorelines	Equisetum pratense – moist meadows
Ceratophyllum demersum - ponds	Mentha arvensis – moist meadows
Eleocharis palustris - bogs	Salix alba – softwood forests
Marsilea quadrifolia - ponds	Juncus effusus – bogs
Myriophyllum verticillatum - ponds	Populus alba – alder forests
Nuphar luteum - ponds	Ulmus effusa – mixed forests
Potamogeton natans - ponds	Frangula alnus – mixed forests
Typha angustifolia - reedbeds	Periploca graeca – mixed forests
Typha latifolia - reedbeds	Orchis palustris - moist meadows
Sparganium erectum - shorelines	Orchis maculata – moist meadows
Nymphea alba – ponds	Hotonia palustris - ponds
Gratiola officinalis - bogs	Nymphaloides peltata - ponds
Trapa natans - ponds	Hydrocharis morsus-ranae - ponds
Iris pseudacorus – moist meadows	Phalaris arundinacea – alder forests
Leucojum aestivum – alder forests	Epipactis palustris – moist meadows

b) Concept list of animal species

Birds	**Reptiles**	**Amphibians**
Nycticorax nycticorax (ann I)Fulica atra (Ann II)	Vipera berus	Pelobates fuscus
Ciconia ciconia (ann I)	Lacerta agilis	Bombina bombina
Lanius collurio (ann I)	Coluber caspius	Rana esculenta
		Rana latastei
Turdus merula (ann II)		Triturus dobrogicus

2. Concept list of sites that will be inventorised

Bosnia-Herzegovina	**Croatia**	**Serbia-Montenegro**
Rača (Bijeljina)	Lužani (Slav. Brod)	Crna Bara (Bljeljina)
Lončari (Brčko)	Banovci	Višnjićevo
Žabar (Modriča)	Davor	Noćajski Salaš
Modrac	Orubica	Begeč(š?)
Klokotnica (rijeka Spreča)	Vrbje	Bačka Palanka
Liješće (Bos. Brod)	Mlaka	Bačko Novo Selo
Patkovača (Derventa)	Lonjsko polje (more sites)	Zasavica
Tišina (Bos. Šamac)	Mokro Polje	Obedska bara
D.Svilaj (Bos. Šamac)		
Bardača		
Srbac		
Bos. Gradiška		
Trnopolje (Prijedor)		
Trnopolje (Prijedor)		

(Cross boundary area on Croatian, Bosnian and Serbian territory included)

3. Timing of the activities

ACTIVITY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Workshop											
Field work											
Database p.											
Report p.											
Data delivery											

- Timetable shows that project predicts start of activities with workshop that should be attended by experts from each of three countries. On the workshop will be attuned choice of plant and animal species whose distribution will be explored through the field work. Also sites that will be visitied will be agreed on.
- Right after the workshop expert teams will start field investigation
- Project presumes six going outs in the field (three days each), in August, September, October 2005., as well as in March, April and May 2006.
- During one going out in the field, will be explored 3 - 4 sites. In the year 2006, inventory will be conducted in the same schedule.
- Parallel to the field work it will be prepared database containing results of field observations.
- Gathered data will be presented in the unique form, as shown in the Working Schedule
- In June 2006 final report will be handover to the Alterra.

4. Standardized format for data delivery

INDICATION OF WETLAND QUALITY

Habitat's data

Topographic sites name		
Coordinates		
Level of protection		
Ownership		
Size (ha)		
Photograph(s) of impression of area		
Surface water (%)		

Vegetation Habitat type coverage (%)	EUNIS class	EUNIS class	EUNIS class	EUNIS class	EUNIS class
Hardwood forest (G1.2)					
Softwood forest (G1.1)					
Wet grassland					
Reedbed					
Flotant					

Indicatory plant species	Belonging to EUNIS class)	Summer/autumn	Spring
species 1	a		
species 21	F		
species 31	B		
species 41	Etc.		
species 51			

species 61			
species 71			
species 81			
species 91			
species 10			

Birds		Number of specimens/ number of couples	Number of specimens/ number of couples
species 1			
species 21			
species 31			
species 41			
species 51			

Reptiles		Summer/autumn	Spring
species 1			
species 21			
species 31			

Amphibian		Summer/autumn	Spring
species 1			
species 21			